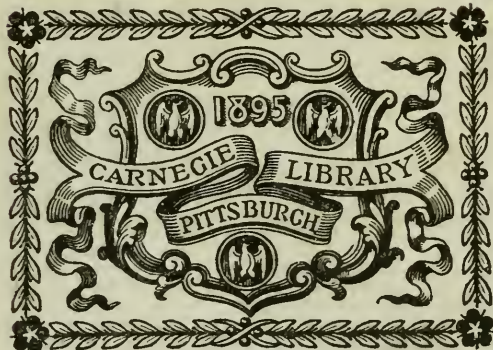


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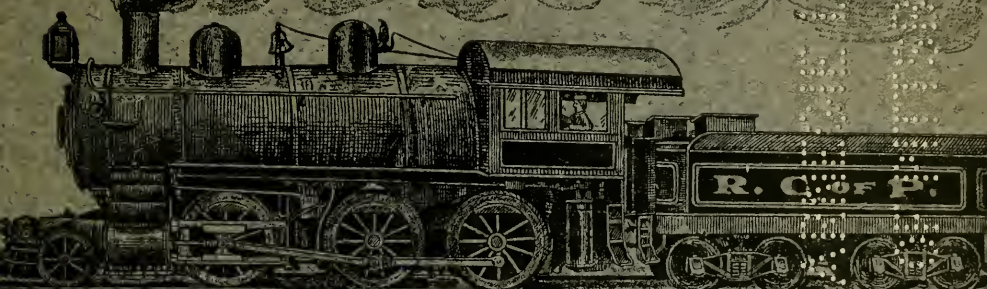
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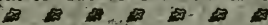
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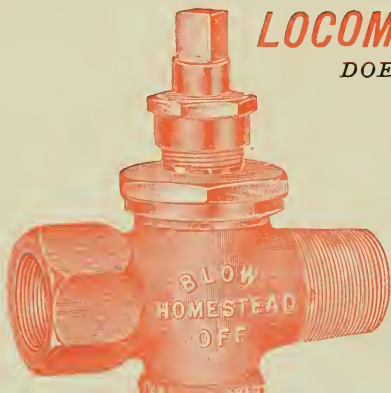
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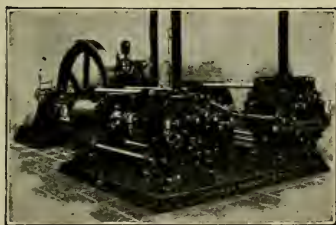


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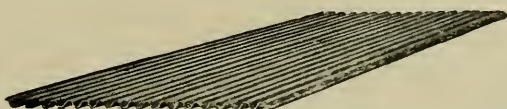
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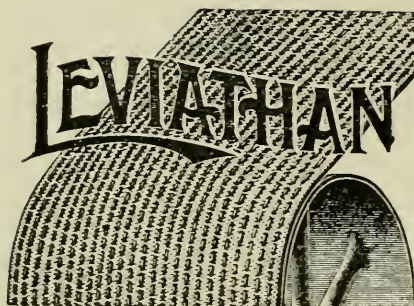
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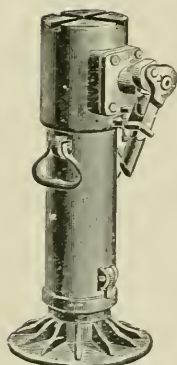
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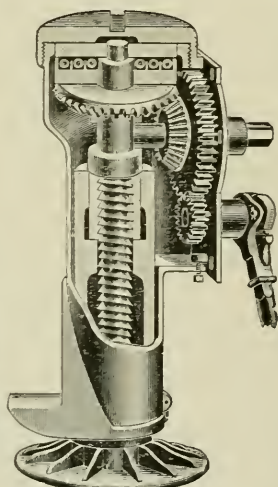
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ALSO SOLE AGENTS FOR

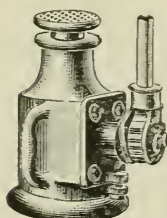
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Pittsburgh, Pa., Nov. 23, 1906.

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Published monthly, except June, July and August, by the Railway Club of Pittsburgh,
J. D. Conway, Secretary, General Offices P. & L. E. R. R., Pittsburgh, Pa.

Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING,
NOVEMBER 23rd, 1906.

The meeting was called to order at the Monongahela House, Pittsburgh, Pa., at 8 o'clock P. M., with President F. H. Stark in the chair.

The following gentlemen registered:

MEMBERS.

Anderson, H. T.	Irwin, O.
Barnsley, Geo. T.	Jacob, W. W.
Brand, Thos.	Kaup, H. E.
Brown, A. D.	Kerr, Jno. K.
Brown, G. P.	Kessler, D. D.
Bruff, J. C.	Kissinger, C. F.
Burrell, J. E.	Knight, E. A.
Campbell, Geo. E.	Lobez, P. L.
Coen, P. A.	Long, R. M.
Coey, David.	Lynch, A. C.
Conway, J. D.	Lynn, Sam'l.
Coulter, A. F.	Mason, R. L.
Cox, P. L.	Michel, Wm. J.
Crouch, A. W.	Millar, C. W.
Cunningham, J. D.	Murphy, W. J.
Currie, J. C.	McCartney, J. L.
Dashiell, J. W.	McConnell, C. H.
Dawson, W. J., Jr.	McFeatters, F. R.
Dow, G. N.	McNulty, F. M.
Elliott, Geo. H.	Nessle, J. B.
Foley, F. J.	Noble, D. C.
Fraser, C. M.	Oates, Geo. M.
Gale, C. H.	Obey, G. B.
Gardner, Henry.	Patterson, S. H.
Garland, C. W.	Peck, C. D.
Gorman, M. J.	Porter, H. V.
Greer, W. J.	Randall, E. J.
Gulick, H.	Ryan, William F.
Gurry, Geo.	Sattley, E. C.
Hackenburg, J. H.	Searles, E. J.
Hall, C. W.	Scheck, H. G.
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Henderson, J. W.	Shaler, Fred J.
Hill, M. H.	Spangler, C. P.
Howe, D. M.	Stafford, Sam'l. G.
Hughes, J. E.	Stark, B. F.
Huyett, E. G.	Stark, F. H.

Stucki, A.	Warne, J. C.
Swartz, H. E.	Warnock, H. R.
Sweeley, G. P.	Weigle, F. S.
Tate, R. H.	Williams, C. W.
Turner, L. H.	Winlo, R. C.
Walker, Geo. G.	Wood, W. B.
Wallace, M. E.	Wood, W. H.
Walsh, Chas. E.	Zinsmaster, F.

VISITORS.

Alleman, Chas. W.	Mader, A. L.
Benton, W. H.	Mooney, J. E.
Bradley, Jas. A.	McGraw, F. H.
Clark, John.	McGraw, J. R.
Cox, P. Y.	McPherson, O. R.
Crannell, Earle S.	McVicker, John.
Dorr, C. O.	Noap, W. J.
Dunbar, F. B.	Obey, J. B.
Dunbar, S. M.	Patterson, Wm.
Earner, J. P.	Porter, M. R.
Fife, W. C.	Rhodes, J. E.
Gillespie, Chas. H.	Scholl, J. L.
Grant, M. H.	Simmons, W. M.
Hobson, B. E.	Smith, Sion B.
Kiser, A. B.	Walker, Harry.
Knox, E. E.	Wilson, J. W.
LeBlond, Wm. R.	Young, John.

Young, Robert.

The minutes of the last meeting being in the hands of the printer, the reading of them was dispensed with.

The Secretary read the following list of applicants for membership:

Chas. G. Bigham, Pass. Condr., P. C. C. & St. L. Ry., Room 107 Union Station, Pittsburgh, Pa.

R. Burgher, President, Kidd Bros. & Burgher Steel Wire Co., Aliquippa, Pa.

J. H. Dunlevy, Freight Agent, Penna. Lines, 70 So. 7th St., S. S., Pittsburgh, Pa.

J. H. D. Eagan, Pres., General Castings Co., Verona, Pa.

Jos. M. Flannery, Secy., Flannery Bolt Co., Frick Bldg., Pittsburgh, Pa.

Howard Flinn, Vice Pres., Kidd Bros. & Burgher Steel Wire Co., Beaver, Pa.

Charles Gifford, Rep., Monarch Steel Castings Co., Detroit, Mich.

A. E. Herrold, C. C. to M. C. B., Monongahela Connecting R. R. Co., 5110 Second Ave., Pittsburgh, Pa.

M. J. Martin, C. C., M. P. Dept., P. S. & N. R. R., St. Marys, Pa.

G. W. McMurray, Foreman, Penna. Company, 1017 Lamont St., Allegheny, Pa.

O. R. McPherson, Genl. Foreman Paint & Equipment Dept., Pressed Steel Car Co., McKees Rocks, Pa.

J. H. Nagle, Engr. Dept., B. R. & P. Ry., Du Bois, Pa.

E. S. Rooney, Dist. Sales Agt., Youngstown Sheet & Tube Co., Farmers Bank Bldg., Pittsburgh, Pa.

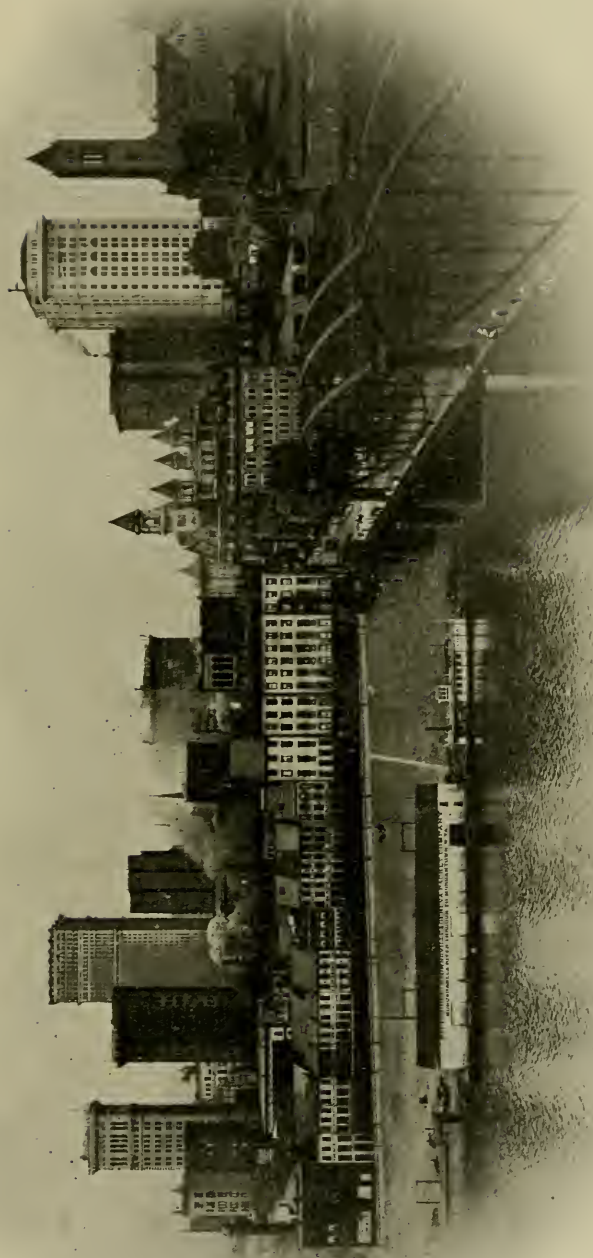
Edgar A. Shuck, Frt. Clk., Lockhart Iron & Steel Co., McKees Rocks, Pa.

W. G. Taggart, C. C. Coal and Coke Dept., P. & L. E. R. R., Pittsburgh, Pa.

E. R. Williams, Vice President, General Castings Co., Verona, Pa.

PRESIDENT: After these applications have been favorably passed upon by the Executive Committee the gentlemen will become members.

If there is no further business to come before the Club, Mr. P. Y. Cox, Chief Mine Inspector of the Pittsburgh Coal Co., will read a short paper on the Production of Bituminous Coal, after which we will have some stereopticon views illustrating the paper.



COAL, ORIGIN, FORMATION and METHODS OF MINING.

BY P. Y. COX, CHIEF MINE INSPECTOR, PITTSBURGH COAL CO.

That coal has originated from vegetable matter during the carboniferous period, ages and ages ago, is the unanimous opinion of every scientific writer on the subject. The many fossils of ferns, leaves, spores and seeds, and various plants discovered in the coal seams, bear silent but convincing testimony to this theory. During this period the vegetation must have been something wonderful, if judged by the form and size of the fossils and the petrified trunks of trees found in the stratas overlaying the coal seams.

This growth of vegetation, which no doubt continued for many centuries, with the requisite amount of heat and moisture, resulted in beds of peat, and no doubt very similar to what is seen in the bogs or peat marshes in various parts of the country at the present day.

The change from peat to bituminous coal took place during a period of submergence, in all probability of the ocean, stopping the growth of vegetation for the time, and commencing the era of the formation of rocks, shales, limestone and the various other stratas; thus the pressure required to transform the vegetable material or peat into coal was applied by the formation of the superincumbent strata of rocks and by means of the sinking of portions of the land; and the elevation of other portions prevented the atmospheric oxygen from participating in the changes, and to this is due the better product of bituminous coal.

The coal period was a time of unceasing change, years, probably millions of years of vegetable growth, alternating with periods of widespread waters, destroying all vegetable life; yet those changes no doubt went forward with such extreme slowness, that if man had been living then he would not have suspected their progress. This theory is well sustained from the fact that, in Western Pennsylvania, we find seven seams of coal at various depths under the great number eight, or Pittsburgh

seam, which practically assures an unlimited supply of fuel for the future.

Anthracite coal is the result of the action of volcanic eruptions on bituminous, attending an upturning of the rocks, the heat driving off nearly all the volatile matter it could develop, and by so doing formed a very superior quality of domestic coal. Anthracite coal is always found in an eruptive or vertical position, while the bituminous is always horizontal or nearly so, is one of the convincing arguments on this point. In some cases the effect of those igneous eruptions has resulted in producing a natural coke or impure powdery graphite. The outcrop of coke thus made near Trinidad, Colorado, can be traced for almost two miles.

The history of coal mining in the United States dates back to 1820, or 86 years ago, though in 1813 what was considered a poor quality of domestic coal was sold in Philadelphia at \$21.00 per ton. It was known as "stone coal" at that time, and for quite a long period was considered a doubtful product. Accounts of the experiments with it as a fuel are amusing in the light of the present day.

The early tonnage of coal was produced by very crude methods. Where the coal outcropped, it was dug with pick and shovel, or, if a shallow shaft, a rude crank and windless was all the machinery used. At one time dogs were utilized in hauling the coal to the pit mouth, in small two wheel carts holding about 10 or 12 bushel, where it was dumped on platforms and hauled away in wagons. At a more recent date mules were employed in hauling the coal out of the mine in small pit cars which held about 25 or 30 bushel, and instead of the platform we find tipples, where the coal was dumped, screened and loaded into drop-bottom dump cars holding about 5 tons. These cars were used to haul the product to market, not on a modern railroad track as we have at the present day, but on wood rails with strap iron spiked on top. But as the demand became greater, owing to the establishing of mills and factories, more modern ways of producing and hauling coal had to be devised, which led to the introduction of the "Dilly," and where conditions were favorable, consisted of an engine connected to a drum on which a rope was wound. The empty cars, gravitating into

the mine, pulled the rope into the parting or siding, where it was transferred from the empties to the loads, which in turn were hauled to the pit mouth and tippie. The power plant in those days consisted of one or two cylinder boilers and the dilly engine. At other places, where grades and conditions were not so favorable, the head and tail rope system was employed, and is still in use in some places at the present day.

The next great step in the production of coal was occasioned by the improved methods of transportation by water and rail, which made it possible to reach markets for our coal in all parts of the continent; and to supply this demand it was found necessary not only to increase the capacity of our mines, but also to open up new and more modern ones. About this time a mine producing 300 to 400 tons per day of 10 to 12 hours was considered a fair average mine, while the mines of today produce from 1000 to 4000 tons per day of 8 hours. This increase is due to the introduction of compressed air and electricity, which is used not only to haul the coal, but also to mine it. With the aid of a mining machine, two men will undermine 150 tons in eight hours. These are followed up by about 12 men, who shoot down the coal and load it in the pit car. To do this amount of work by hand, it would require 30 to 35 men.

As the workings advanced underground, the cost of hauling the coal to the pit mouth, shaft or slope bottom, in places where the dilly could not be used to advantage, became so great as to be prohibitive, which led to the introduction of the electric locomotive, which has proven to be one of the most useful and economical methods known at present.

To operate mining machines and locomotives economically, it was necessary to install modern power plants or stations, and to tear down and do away with the "dear" old cylinder boiler. At some of the larger mines of today we find as many as ten 150 horse power horizontal tubular boilers supplying power to one operation. To still further economize it has been found advisable to have central power plants, whereby several mines are operated from the same station. Where this has already been accomplished, all the machinery, ventilating fans, mechanical hoists, pumps, machines and locomotives are operated by electricity. It will thus be seen that coal mining, like railroading

and other large industries, has made wonderful progress, especially in the last few years.

In the production of coal from the mine there are four important items of expense: 1st. The cutting and loading. 2nd. The hauling, dumping and screening. 3rd. Keeping the mine secure and free from water. 4th. Ventilation. The two first items are plain to everyone, but those who are not acquainted with coal mining have no proper idea of how much it costs to handle and pump the water, supply the miner with good, pure air to breathe, and remove the dangerous gases.

The record made in the bituminous coal fields of Pennsylvania during the year 1905 was something unprecedented in the history of coal mining, the production amounting to 118,413,637 tons. Of this amount the Pittsburgh Coal Company and its affiliated interests produced 20,156,233 tons, or a little more than one-sixth of the production of the entire state, which is a wonderful showing for one company. During the year this company employed at their mines 37,648 men, while at their shops, docks, railroads and other employment, a grand total of 46,130 men employed by the Pittsburgh Coal Company is shown in 1905. It is now known that the production of coal in 1906 will considerably exceed that of 1905, especially in Western Pennsylvania.

PRESIDENT: You will remember that about a year or more ago the members of the Railway Club of Pittsburgh were promised a trip through the mines, and that part of the program, you will remember, was cut out. It is our purpose tonight to give you that trip. Before doing so it would be proper to introduce some of our officers to our members and guests in order that they may properly entertain you during this journey.

1. We have here our first President; a man small of stature, but a giant in intellect; a man who is the ideal of many a master-mechanic who has aspirations for something better. I know you will all be pleased to greet our first President. (Picture of J. H. McConnell, the first President of the Club, shown on the canvass here.)

2. We will now introduce to you our second President, the most popular railroad man in Western Pennsylvania. You will

notice that out of profound reverence for the ladies he, too, has shaved his head. (Picture of L. H. Turner presented.)

3. We will introduce to you our worthy Treasurer, a gentleman whom you all know and who has a fondness for rail-roading, although he has been promoted with a degree of "Commercial Engineer."

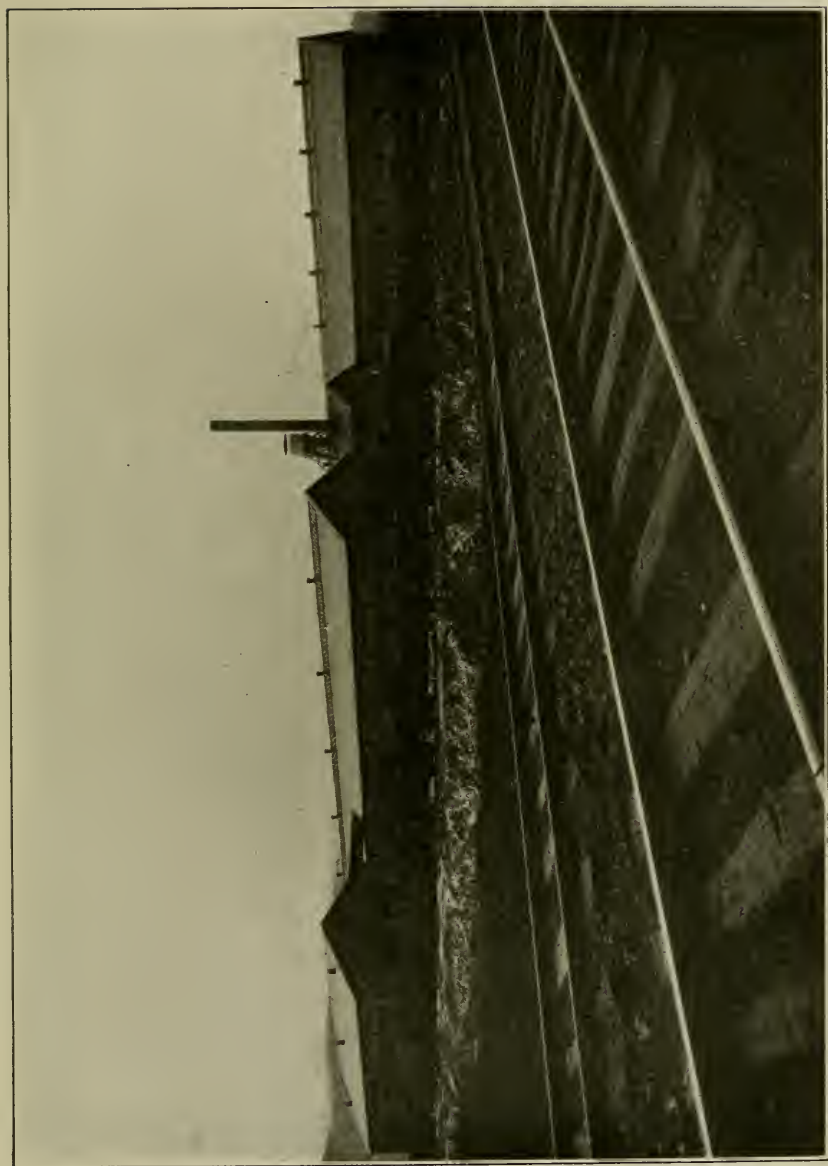
You have now been duly introduced to our officials and we will now have the privilege of enjoying a personally conducted tour through the mines under the management of Mr. J. W. Riley. He is back among the ladies and has delegated me to act as a sort of conductor while going overland, and—and I have some friends here who will act as interpreters when we go under ground.

Through the courtesy of the P. & L. E. we have a train at our disposal, and as the trains on this road always leave and arrive on time you will kindly be prompt in boarding the train.

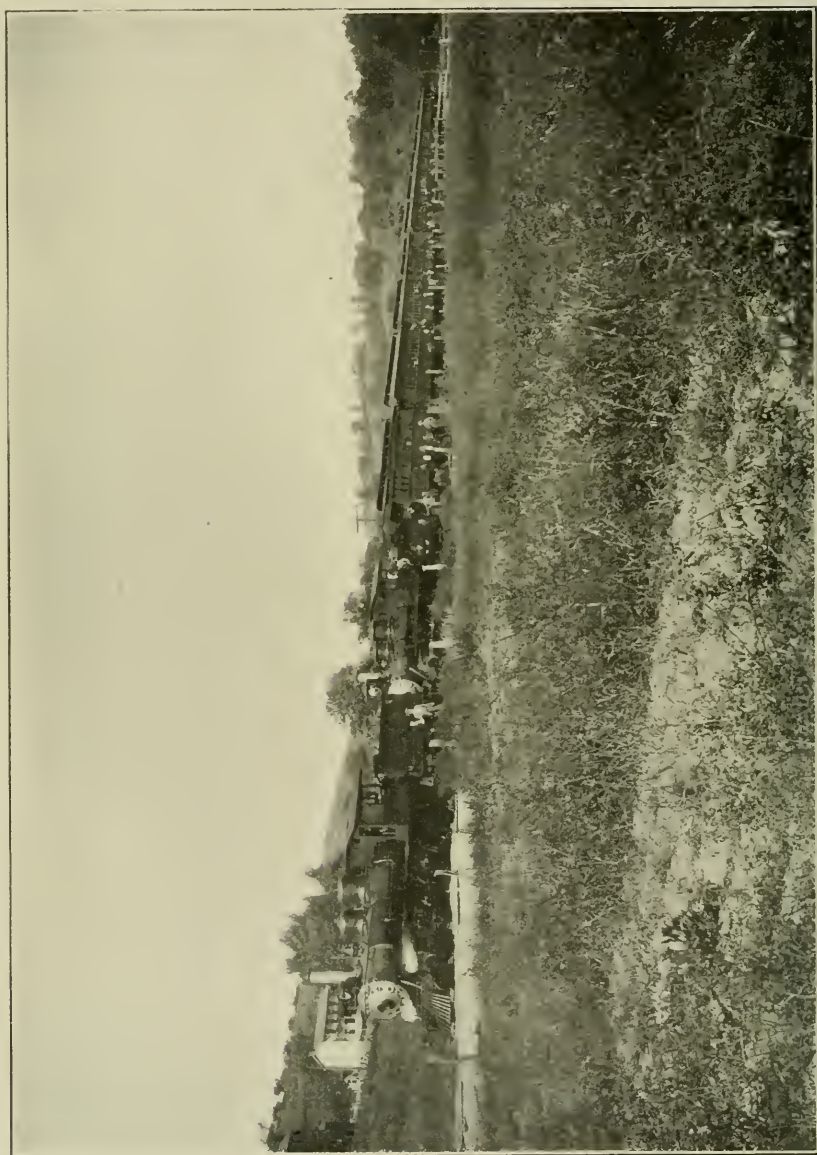
We are now on the P. & L. E. and your first point of interest is the shops of the Pittsburgh Coal Company, where they maintain their rolling stock, consisting of something over 6,000 cars and quite a large number of locomotives. also build thousands of mine cars annually, together with repair parts that are furnished the mines. You have here a view from the south.

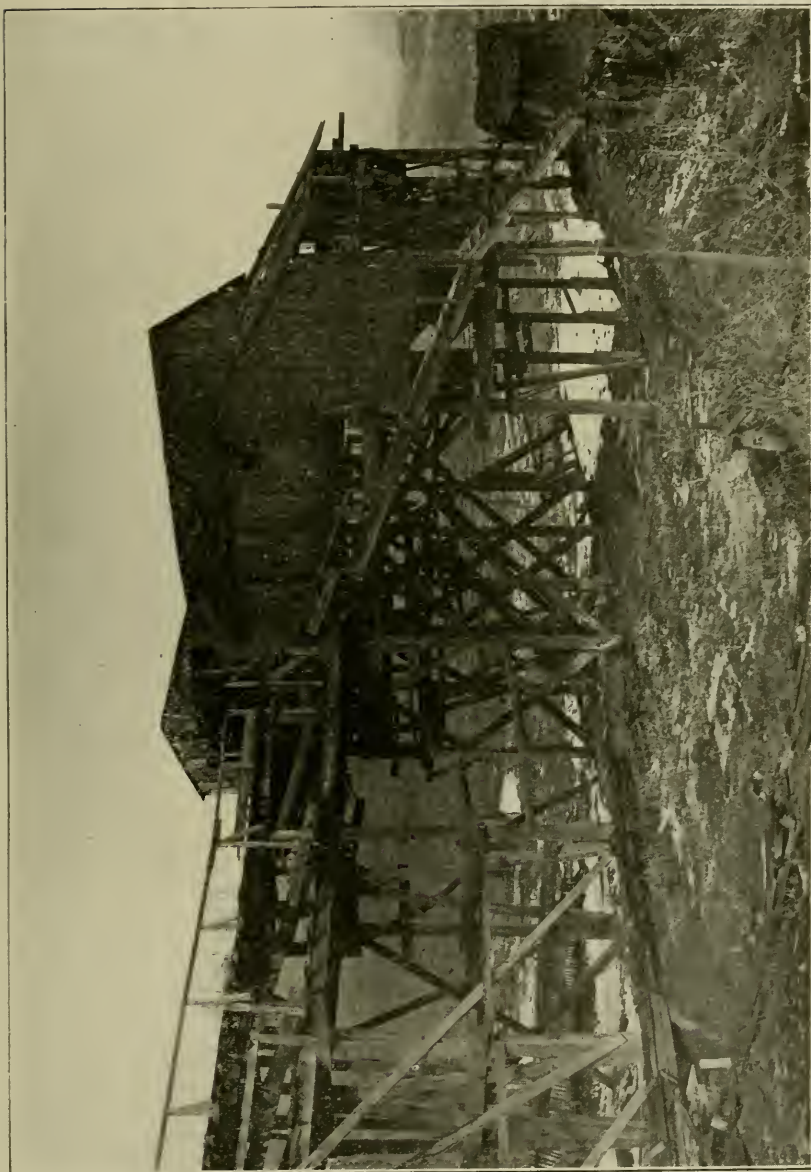
We are now nearing Montour Junction and will be transferred to the Montour Railroad. We have a double header. On account of the grades and curves it is necessary to employ two locomotives to convey the Railway Club and their guests.

We have now arrived at Imperial and you will notice in the distance the Montour tipple, which has long since been abandoned, which will serve to give you a good idea of early mine tipple construction.



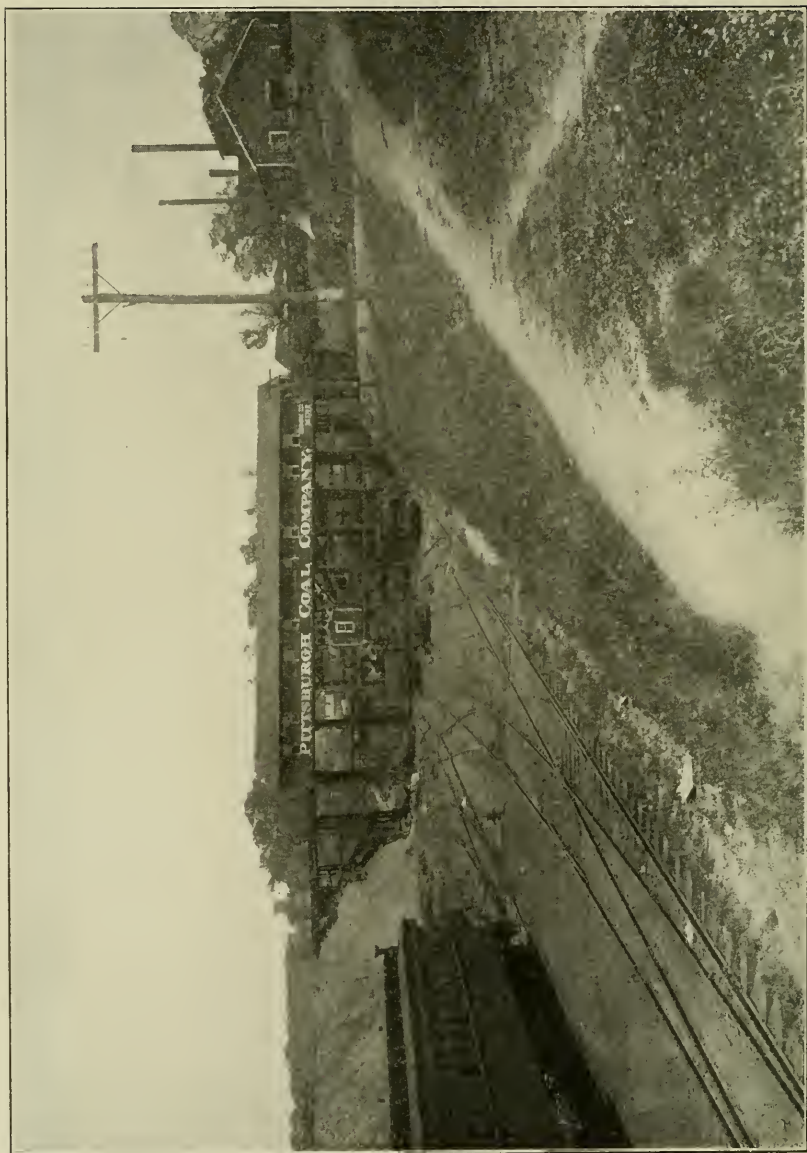
Pittsburgh Coal Company Shops, Montour Junction.





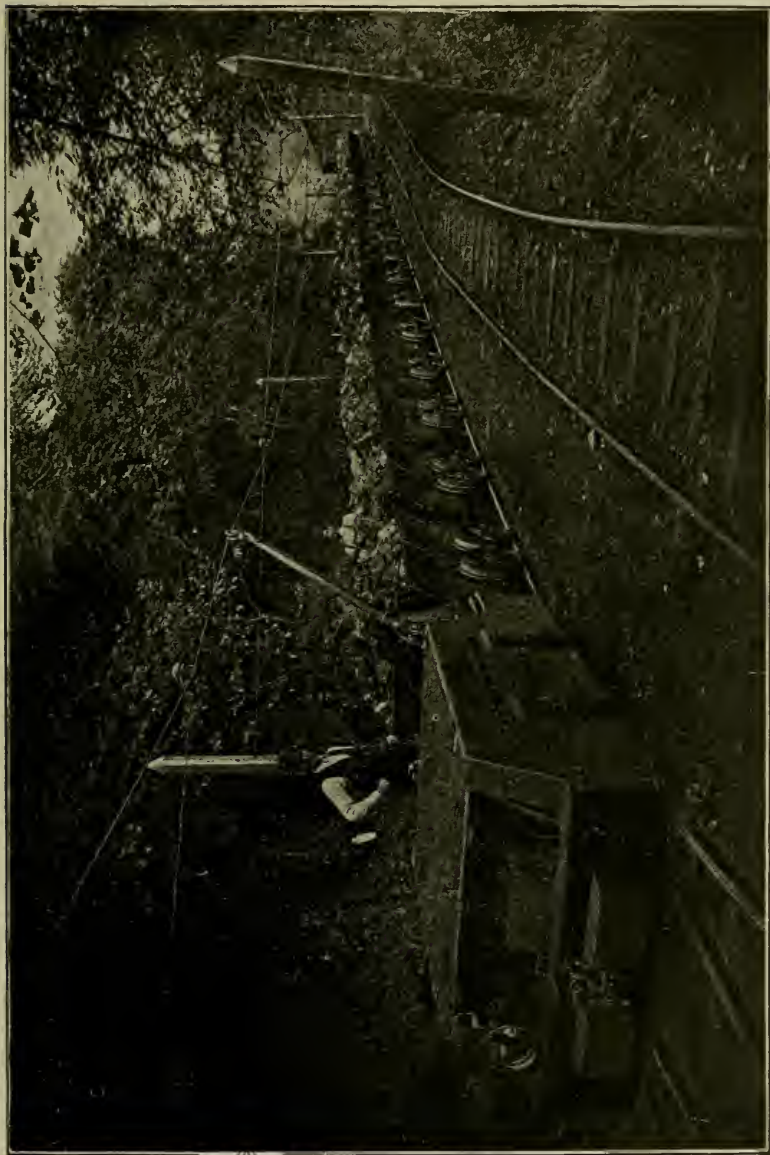
Montour Tipple.

We will now board Col. Miller's airship and pass over the hills a distance of about six miles where we will visit the Moon Run mine. This mine has the reputation of producing the very best quality of coal for certain purposes.



MR. P. Y. COX: This is a good picture of the Moon Run tippie. It is noted for the excellent quality of its coal for domestic, steam and gas purposes. The height of the coal is about 5' 8" or 9" and the production is a very large one, something

like 2000 or 2200 tons of screen coal per day. It is operated by compressed air and electricity.



PRESIDENT: We have a view at Moon Run of a train of coal cars. Mr. Kiser will explain to us the construction of the locomotive.

MR. A. B. KISER: The first view shows a modern type four-wheel electric locomotive, weighing thirteen tons, equipped with two fifty horse-power motors, wired for a five-point rheostatic controller, with a separate switch for throwing the motor either in series or parallel. This locomotive will develop 3500 pounds draw-bar pull continuously for one hour at a speed of six miles per hour, or on an ordinary level mine track will pull forty loaded cars of three tons each, without overloading, and is capable of an overload for short periods of 75 per cent without undue heating.

The locomotive is nothing more than a heavy cast iron frame on which the motors are suspended in the same way as in street railway practice—the motors themselves being, as a rule, the heavier type street railway motors.

We have lately introduced several twenty-ton, six-wheel locomotives, in which the load is equalized on all six wheels in a manner similar to that used in steam locomotive practise. We are running them every day on 40-lb. rails and find that owing to their greater length of wheel base and to their having six wheels we do not get the tilting motion so common in the four-wheel type, and that the pounding of the track is less for the twenty-ton locomotive than for the old style 10-ton locomotive.

The power is taken into the mines and to the locomotives in the same manner as daily seen on our street railway systems, the only difference being in the method of suspending the trolley, which in mine work is usually hung on cross timbers which are latched into the coal or rock on each side of the entry.

We have also installed, with good success, what is known as a "rack-rail" locomotive, differing from the ordinary rack-rail type in that the rack acts as the trolley. The rack is placed near the middle of the track just below the top of the rails. There are two sprockets insulated from the locomotive axles, which pick up the power from the soft steel rack and carry it through a suitable controller to the motors, which in turn drive these same sprockets and cause the locomotive to advance. By this method we are hauling twenty-car trips up a $10\frac{1}{4}\%$ grade, with a locomotive weighing only six tons. Another remarkable thing is that, although the rack is insulated with nothing but wood blocks and runs 1600 feet into a damp mine, I have never seen a leakage greater than two amperes, the voltage on the rack being 500.

We now pass to a view showing how coal is mined by air with what is commonly called a "puncher" machine, owing to the punching or pick action of the machine. This machine itself is nothing more than an air cylinder mounted on two 15" wheels, with what might be called a piston rod with a fish-tail pick on



the end. The entire machine is placed on an inclined platform and is guided against the coal by the man in the rear as shown. The usual size cylinder is 4" in diameter, and strikes a blow of 650 pounds. The capacity of these machines is as high as

50 tons undercut per day of eight hours and in a five-foot vein—but a fair average day's cutting would be 35 to 40 tons.

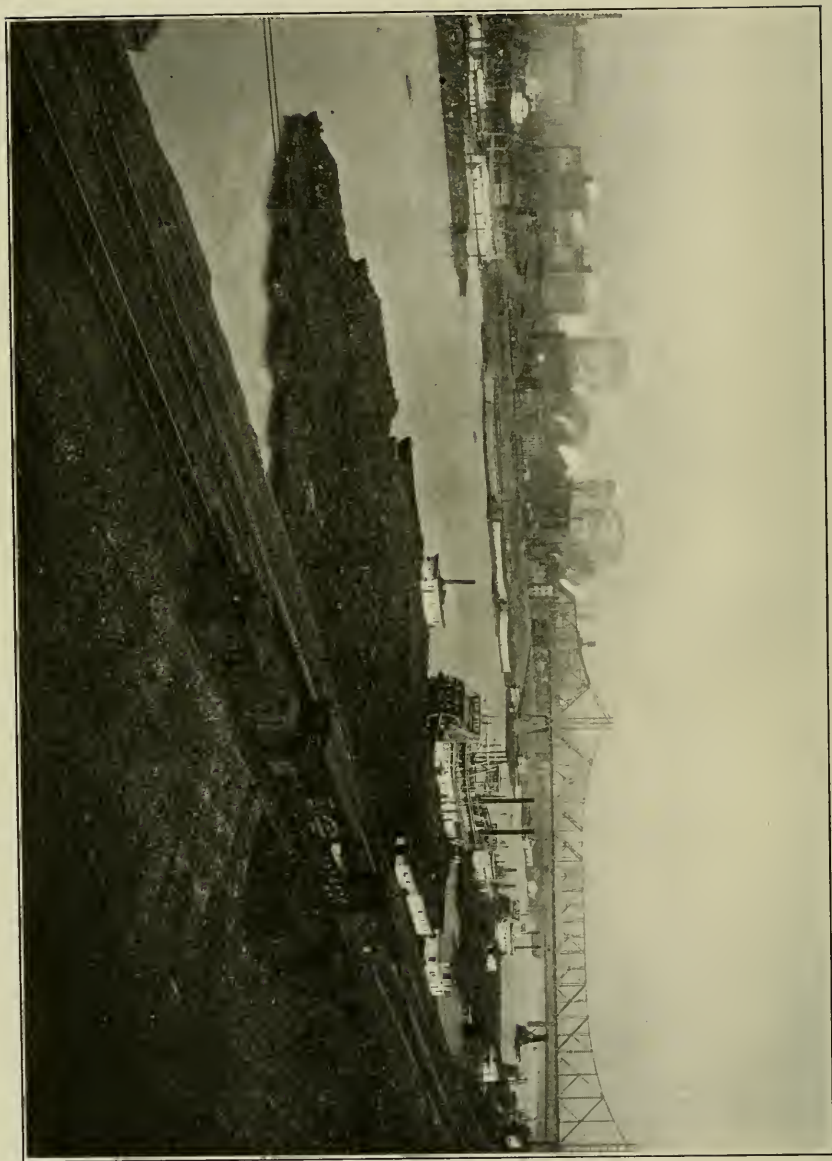
We will now show another type of mining machine. This is what is called an electric chain breast machine. This machine differs from the one just explained in that the former machine punches the coal while this one saws or chisels it. It is composed of a 20 horse-power motor mounted on a telescopic frame; the inner frame, to which the motor is attached, is made up of a heavy center rail or channel, to which a cutter head is bolted



at right angles at the forward end. This cutter head is made up of two cast steel plates which contain the necessary guides and rollers at each end for allowing a cast steel sprocket chain to pass around. Each block in the chain carries a bit or chisel, which cuts the coal and at the same time moves forward; the bit advances under, then across the front of the cutter head and out the other side, thus making what might be called a flexible saw. This machine will undercut six feet deep by 44" wide, by $3\frac{3}{4}$ " high, in about four and one-half minutes—or, allowing for moving from room to room, will undercut from 100 to 150 tons of coal per eight hours.

PRESIDENT: We will now soar across the hills and visit a model mining village. Here you will notice that each house has a spacious yard to itself, adding comfort and health to the inhabitants thereof.



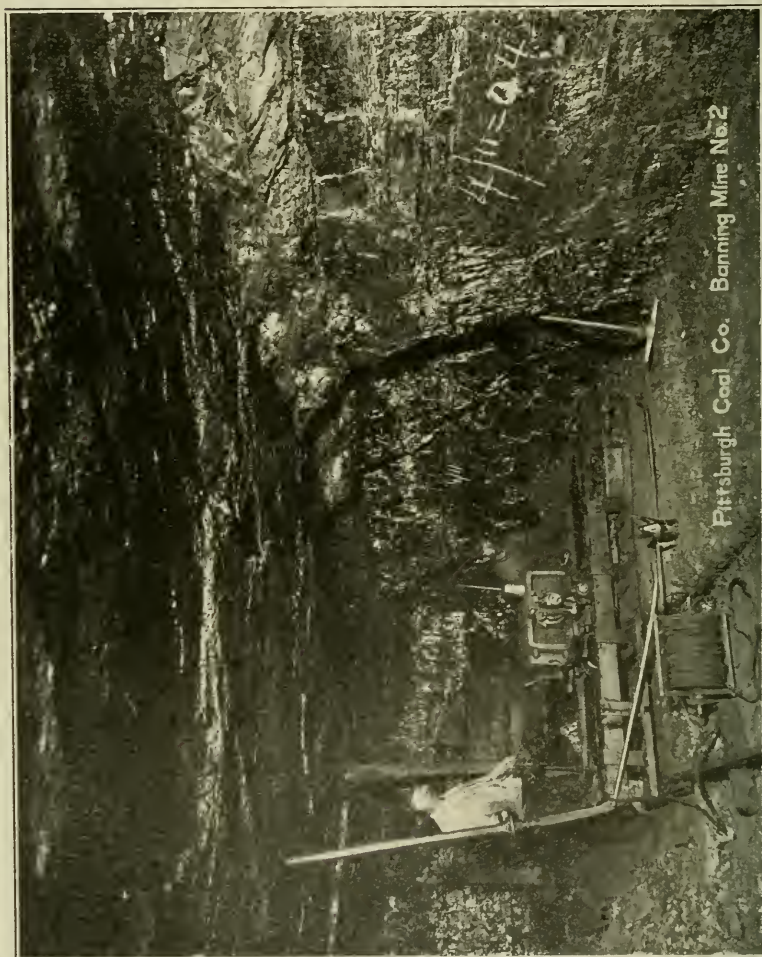


We will now change your direction to what I presume is southeast and pass over the Monongahela River. Here you will find a fleet of river coal boats near the Wabash bridge.

We are still traveling southeast over the coking region. Here we have the Colonial Coke Company's plant. Perhaps Mr. Cox can tell us something about the coking coal of that district?

MR. P. Y. COX: The Colonial Coal & Coke Company's plant is located at a place called Smock on the Red Stone branch of the P. V. & C. R. R. between Brownsville and Uniontown. The Pittsburgh Coal Company owns and operates something over 1000 ovens here.

PRESIDENT: We have now arrived at Banning No. 2.



MR. P. Y. COX: This is a mine on the Youghiogheny River. The tippie is of all metal construction of most modern design. The coal is a very superior quality of steam coal and height is about eight feet from floor to roof.

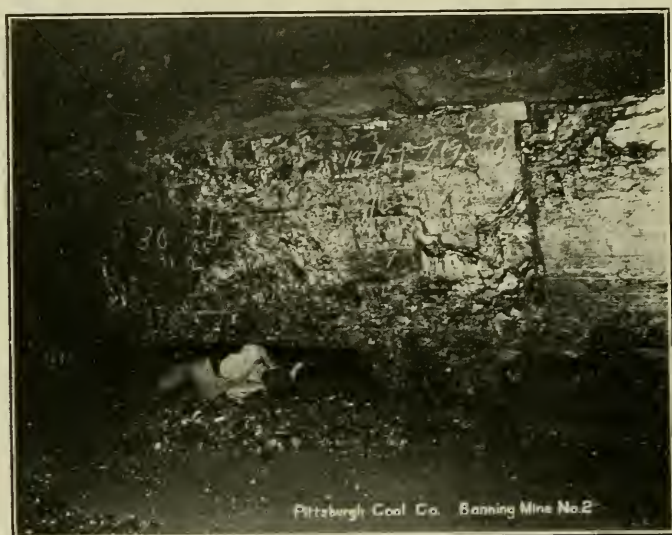
MR. A. B. KISER: This view shows the interior of our



Banning No. 2 central power plant, in which is installed all the necessary machinery for generating power for our Darr, Banning No. 1, Wick Haven, Banning No. 2 and Whitsett Mines. It is composed of one 300 kw. generator, direct-connected to a 24" x 24" engine, running at 185 revolutions, and two 150 kw.

generators, direct-connected to two 21" x 20" engines running at 200 revolutions, each generator in turn being connected to a switchboard through lead cables run in conduits under the cement floor. The switchboard is of standard blue Vermont marble, railway type panel board, and at present contains eight panels, three for the generators and five for the mine circuits, each mine circuit having a separate quick break switch, ammeter and circuit-breaker. Owing to the boiler plant at this mine being located on the opposite side of the P. & L. E. tracks and about 200 feet away, it was necessary to locate the heater in this building and conduct the hot boiler feed water under the tracks to the feed water pumps in the boiler room. This is being done very satisfactorily and with very little loss of heat by having a small feed pipe, which is heavily covered with cork pipe covering.

The endless rope haulage engine and tension rig are also installed in this building. This engine is a 16" x 24" duplex, and is capable of delivering 3000 tons of coal on the tippie per day—at a rope speed of 80 feet per minute, the cars being attached to the rope in pairs by means of a screw clamp.



MR. P. Y. COX: This is a miner of the old type working with a pick. The modern mining machine does away with this man and instead of undercutting with a hand pick it cuts under the coal about four inches high and to a depth of seven feet in some mines, depending on the height of the coal, and each cut in turn is about four inches wide.

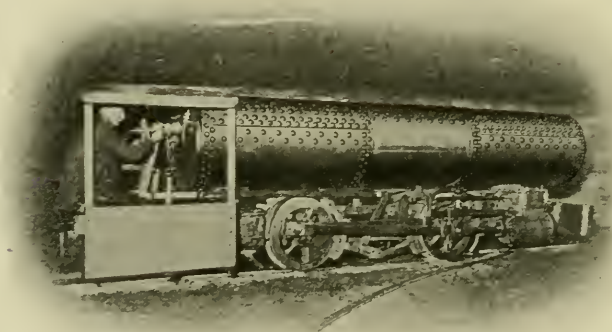
PRESIDENT: Is this hand method employed now to any extent?

MR. P. Y. COX: This method is worked at the present day in some places where the operation is dangerous, and especially in drawing the ribs. Machines have been tried in some cases, but it interferes. In drawing the ribs and dangerous places under the roof the old style has to be employed yet.

PRESIDENT: We will now continue our voyage a little southwest to the First Pool mine.

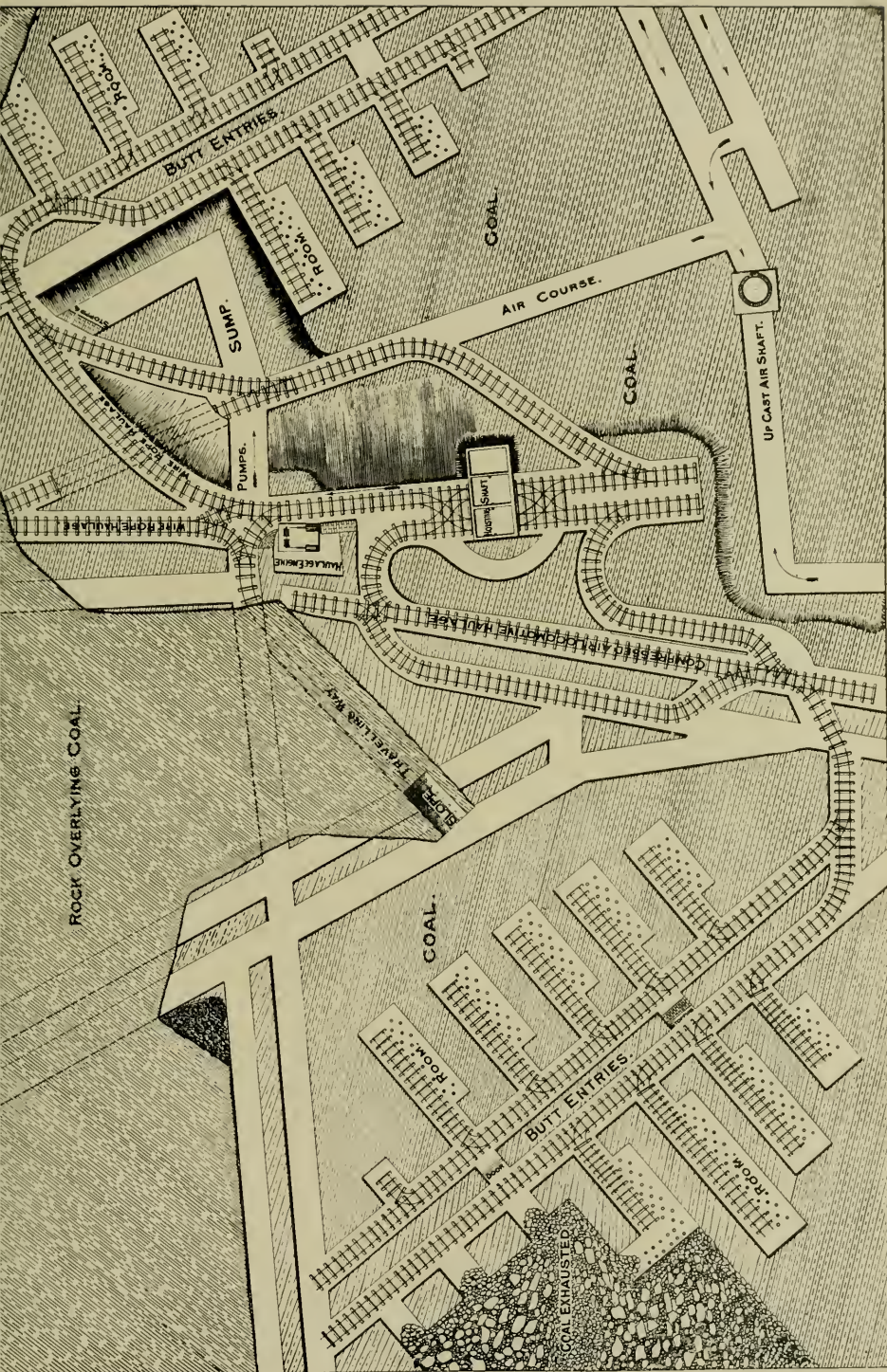


MR. P. Y. COX: This is a mine on the B. & O. R. R. at a place called Willock. It is a model mine in every respect. The seam of coal is about the same as the other. The height runs 5' 8" or 9". It is considered the best coal probably around the Pittsburgh district. The output is about 1500 to 1800 tons run of mine coal per day.



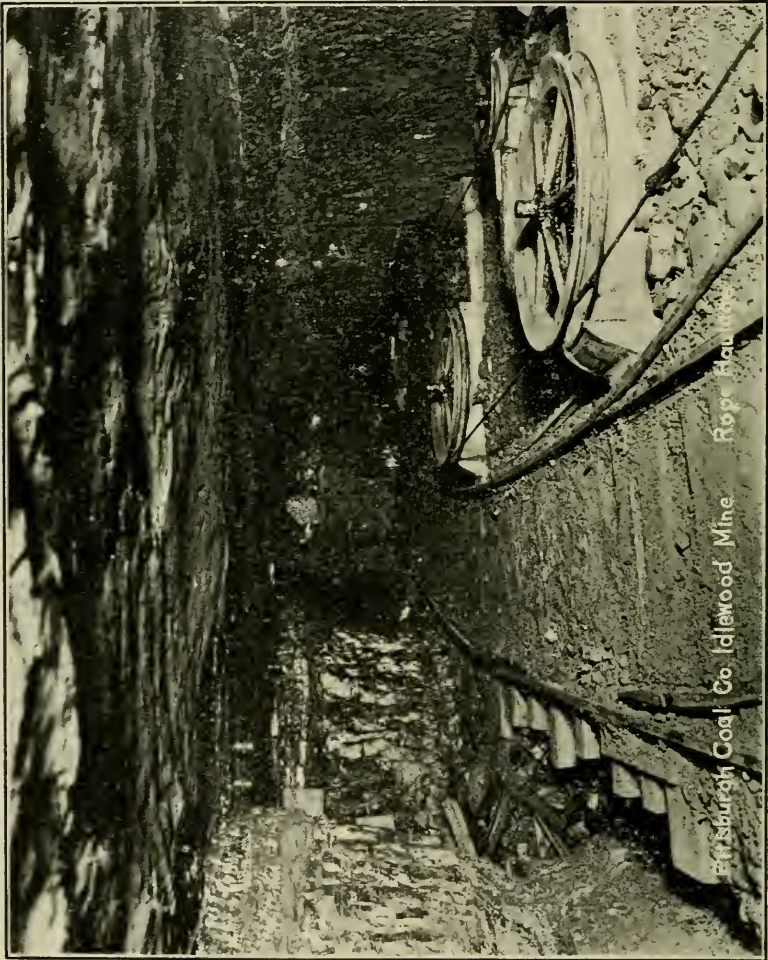
MR. KISER: The air locomotive shown is fifteen tons in weight, with cylinders $9\frac{1}{2} \times 16$, working under 150 lbs. air pressure, and is capable of pulling 48 loaded cars up a $1\frac{1}{2}\%$ grade. The air for this locomotive is compressed by a four stage compressor as follows: The first cylinder picks it up at atmospheric pressure and compresses it to 32 lbs. per sq. in.; then it is passed to the second cylinder and compressed to 150 lbs.; then it goes to a third cylinder and is raised to 500 lbs.; then to the fourth cylinder where it is compressed to 1050 lbs. per sq. in. It is then conducted to the charging station. The air on the main tanks is carried at about 900 lbs. pressure and the two tanks having a capacity of 130 cu. ft. can be charged in less than one minute and after making a trip of 16,000 feet return to the charging station with 250 lbs. pressure in the main tanks.

MR. P. Y. COX: This is a plan of the underground workings of First Pool Mine No. 2. You will notice the different entries where the rooms are turned off. These rooms are the workshops of the miner.



PLAN OF THE MODEL OF THE PITTSBURG COAL COMPANY'S
FIRST POOL MINE NO. 2.

MR. A. B. KISER: These are the wheels of an old rope haulage. I say old, because it is not modern mine practice,



though these mines are in operation at Idlewood. The turns are very abrupt and it shows the method of carrying the rope around the turns.



PRESIDENT: This is a miner returning home after his day's work.



Here we have the indispensable, the "horseless" carriage.

Here we have one of our car dumping machines coaling one of the large passenger vessels of the Lakes. (Page 355.)

Here is one of the many coal storage docks in the Northwest, where thousands of tons of coal are stored during the lake season for winter supply. (Page 356.)

As you have all been very patient and the hour is late, we will return to Imperial to take our train for the homeward journey.

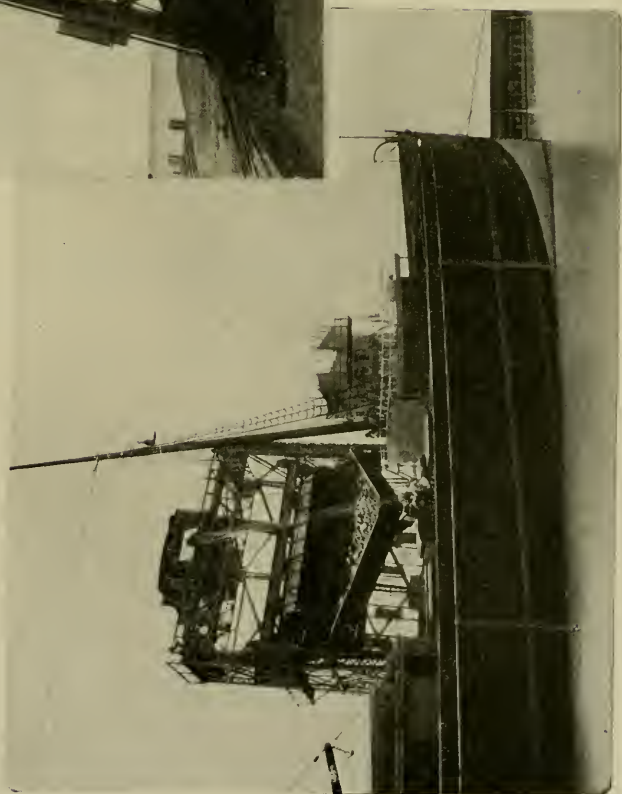
This will conclude this part of the program. Perhaps someone may have some questions to ask our friends, Mr. Cox or Mr. Kiser, and if so they will endeavor to answer them.

MR. J. B. NESSLE: I would like to ask Mr. Cox whether in the Colonial mines in making these cuts they cut all the coal clear to the bottom, or leave a little at top and bottom.

MR. COX: They always leave about six to eight inches of the bottom coal in and about four to six inches of the roof. The bottom of the seam of the Connellsville coking seam has so much sulphur in it that it destroys the coke, so they leave in about six inches at the bottom and also at the top.

MR. J. B. NESSLE: And the ordinary cutting machine takes out about four inches?

MR. P. Y. COX: In the Connellsville coke region they do not use machines for that at all. They take out all the coal by







pick. The coal is so soft a punching machine will not work well. Lately when they get into places where the coal is a little harder than it used to be they put a hole in the face and put a shot in there. It does not knock the coal down, but it kind of softens it so they can dig it more easily. But where they use machines they leave about four inches of the bottom coal in the Pittsburgh seam.

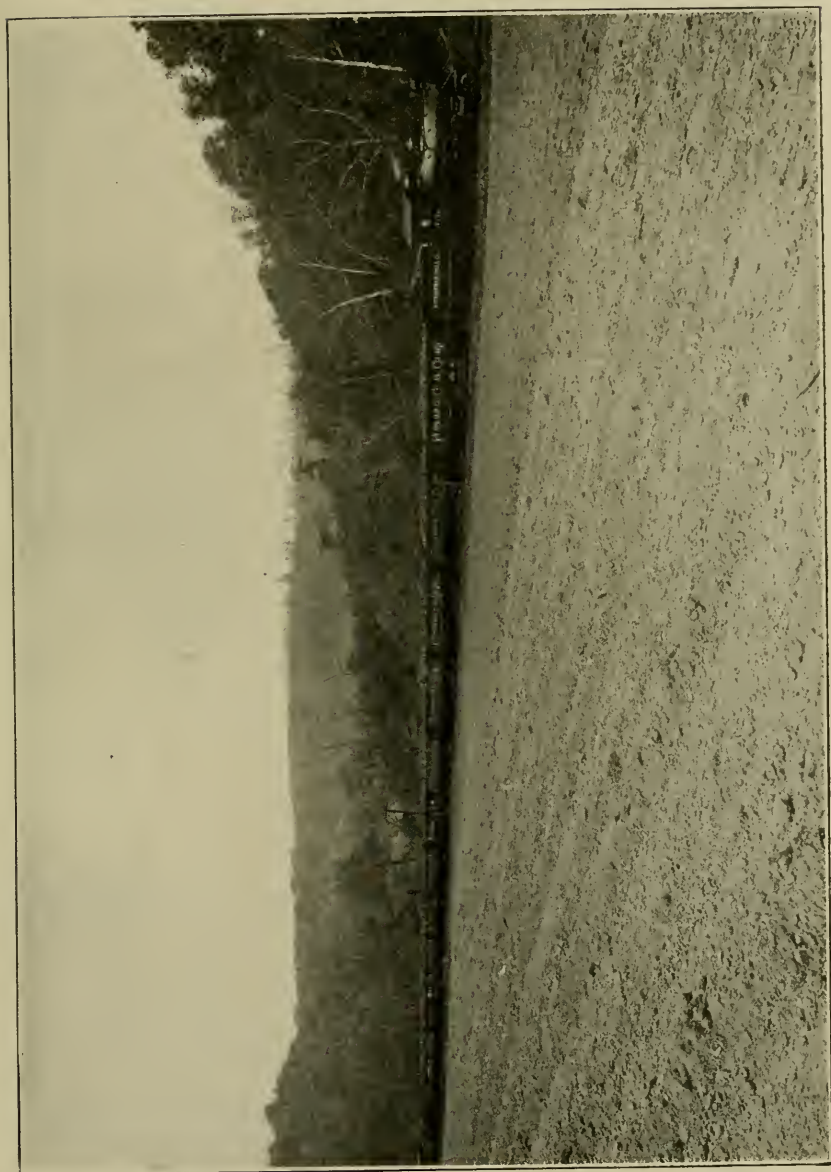
MR. L. H. TURNER: I was quite interested in that question. I have heard some of our locomotive firemen say that you went about six inches under the bottom.

MR. P. A. COEN: I would like to ask Mr. Cox what per cent of the coal is never recovered, that is in the shape of old stumps and ribs that are never drawn. A great many foreign engineers visiting this country in 1904 and coming to the Louisiana Purchase Exposition expressed themselves as believing that our methods were not very economical.

MR. P. Y. COX: Up until recently our methods of mining were anything but economical and I suppose there were mines in the Pittsburgh district as late as four or five years ago where they left in about 50 per cent of the coal. I believe, however, today we are endeavoring to get out somewhere about 90 per cent of the coal, and we are doing it.

MR. A. STUCKI: I notice you are using air as well as electric locomotives. I would like to know, roughly speaking, whether you can make any comparison with regard to economy in the two types. Of course, I realize the fact that you do not care very much for economy in fuel, but it might be interesting to know which of the two locomotives is the most economical as to first cost and installment.

MR. KISER: In the Pittsburg district it is divided up among a number of operators. But modern mines are being equipped entirely with electricity. The locomotives that are being bought now run, I suppose, at an average price of \$3500 for a 20-ton locomotive. You can hardly duplicate these air locomotives in the First Pool No. 2 for twice that. It would be a half more anyway. Then, of course, you have to take into consideration the expensive outfit at your plant in the way of four stage air compressors. To duplicate this with an electric system would



cost about \$3000 to put in a 150 kw. machine operating a 20-ton locomotive, and you would have as much or perhaps more, \$3500, to put in an engine direct connected with the same, that would make a complete cost of \$6500 for an electric system. But your air compressor with the foundations and all, and the wear and tear and everything considered, would possibly equal twice the cost of the electric system. Another consideration is economy in repairs. I have made some inquiries about this air locomotive and they said the repairs cost them considerable. I asked if it costs more than the electric locomotive, and was informed they thought it did.

A MEMBER: What does it cost to operate?

MR. KISER: I do not know.

PRESIDENT: Do they find it advisable to introduce electric power instead of air power on account of the water in the mines destroying the pipe lines for air?

MR. KISER: There are some mines where this would be quite a consideration, where the pipes to be preserved would have to be elevated from the road bed, where if they were exposed to water they would not last six months. There are conditions you have to meet in different mines that give you all kinds of trouble. Of course, we can take what people are doing at the present time, as they are putting in entirely electric haulage.

MR. P. A. COEN: While considering the mining of Western Pennsylvania coal, it occurs to me that the quality should be considered to some extent. While some states produce but one quality, Western Pennsylvania alone produces steam, domestic, coking and gas coals. Certain lines, often the pools in the river, defining the location of the various grades.

Western Pennsylvania coal as a steam producer and domestic fuel is well understood. As a gas coal adapted to pottery use it has been properly appreciated, but is coming into a more general use daily. The potter requires a coal low in ash, low in sulphur, making a moderate or no clinker and must not form a compact coke. It must be a long flame coal. It follows that the coal should not be under 30 per cent in volatile combustible matter. We have handy to Pittsburgh the ideal pottery fuel.

In further considering gas coal we must consider producer gas and retort or coal gas.

The manufacturers of the Pittsburgh district having had natural gas in what was first believed to be inexhaustible quantities at the very doors of their plants, naturally gave gas coal but little attention. On account of the comparatively limited geographical distribution and the uncertainty of its permanency, which is so seriously threatened at the present time, compels us to consider other gaseous fuels for the manufacture of steel and the heating and lighting of our homes. Other cities far from the gas belts have made the tests, and today, almost regardless of freight rates or location, find it economical to use Youghiogeny gas coal. The present development of the gas producer is rapid and while almost any bituminous coal will produce gas to some extent, Western Pennsylvania coal is used because of its rich yield, making the cost of the necessary plant and the cost of labor and consumption of fuel less. In this connection let me suggest to the buyer of gas coal that he disregard all analysis, as you cannot determine the quality of a gas coal by its analysis. The fact that a coal contains an unusually high per cent of volatile combustible matter is no assurance that the yield of that coal will be greater than that of a coal showing a lower per cent of volatile combustible matter. Laboratory work is all very well and the work of the chemist may be accurate, but actual experience with a coal in a retort or gas producer is necessary.

The average yield of Second Pool Youghiogeny in a gas house retort is as follows:

10,000 cu. ft. of $17\frac{1}{2}$ candle power gas per ton.

1,400 to 1,440 pounds of the best gas house coke manufactured.

12 to 14 gallons of tar which is of an excellent quality.

12 to 13 gallons of ammonia liquor.

And sulphur under one per cent.

The Western States, while having coals which produce a fair yield of gas, contain so much sulphur, making it difficult to purify the gas. The per cent of sulphur in Youghiogeny coal does not vary, running the same from year to year.

The manufacturing and railroad interests of Pittsburgh are blessed, not only with the proximity of their fuel, but fuel of a quality which borders on the ideal.

PRESIDENT: We will now have a little intermission and then enjoy some refreshments. I trust that all will remain and assist in continuing this social hour. It is the social features of this Club that have largely made it so decided a success, and yet at the same time we feel that we have not lost sight of the serious, practical thought that should come before a Club of this character. I believe that the subjects that have been presented here will compare favorably with those of our sister clubs. Our program to-night was hurriedly gotten up, we had but a short time to prepare for it owing to a previous disappointment, and the men who have taken part are all busy men, and I am sure the Club appreciates their efforts. We will be glad to have all of you come again next month, when we will have a paper on the growth of timber from the Forestry Department of the Government. A motion to adjourn is in order.

ON MOTION—Adjourned.

EDWARD KÉRR, President.

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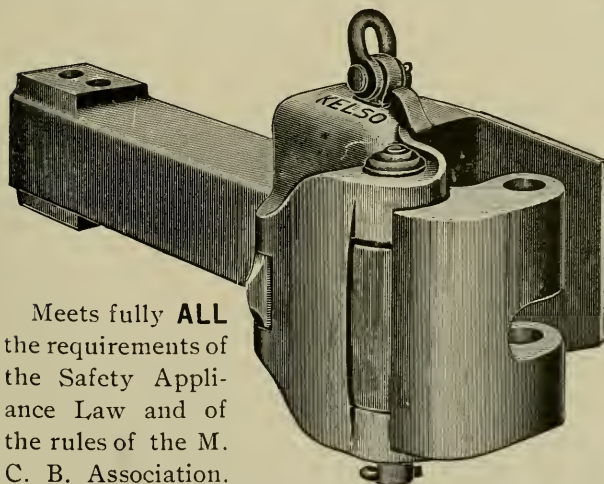
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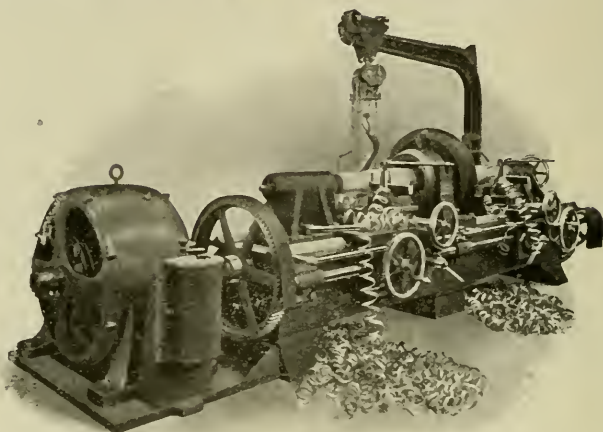
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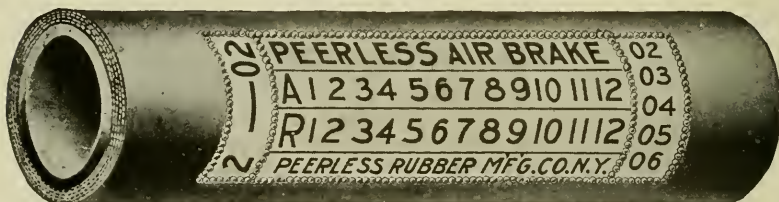
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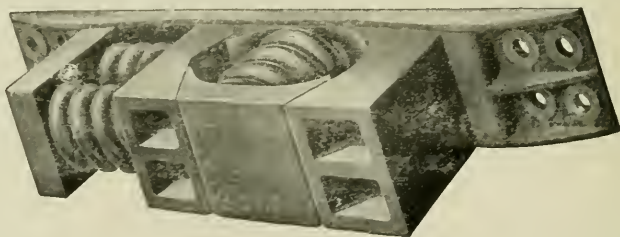
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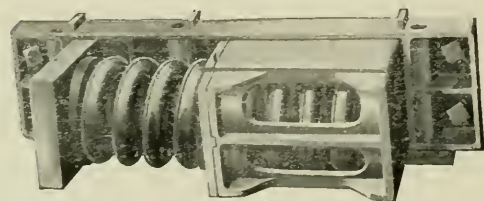
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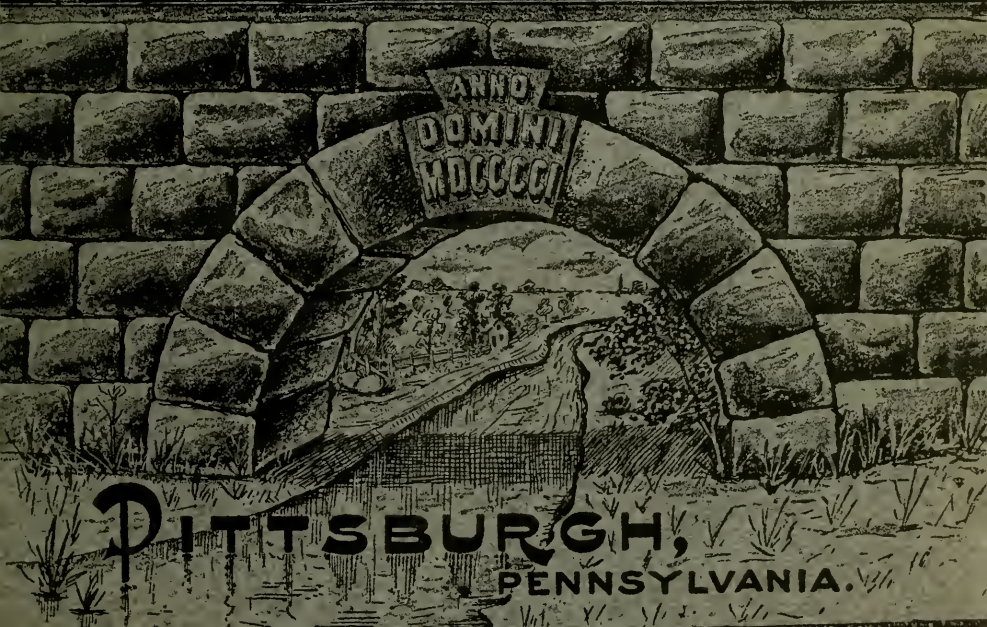
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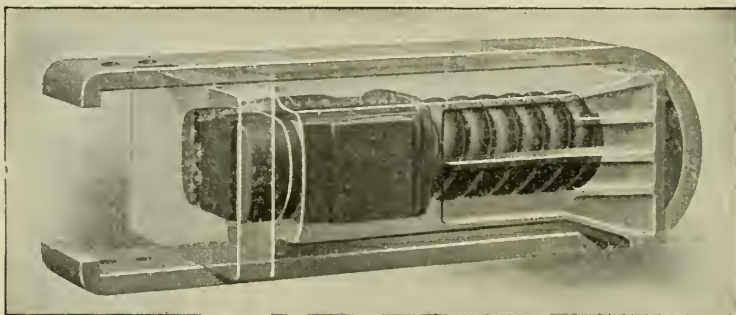
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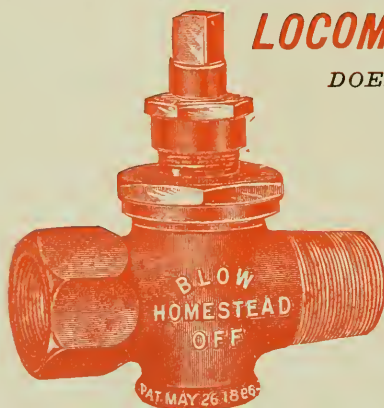
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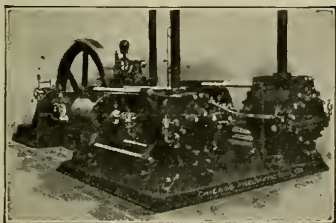
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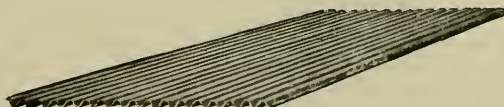
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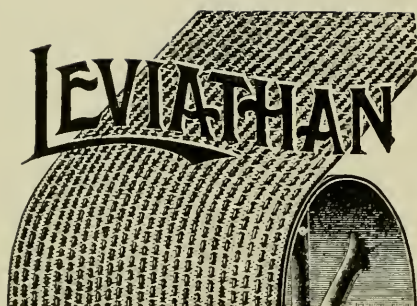


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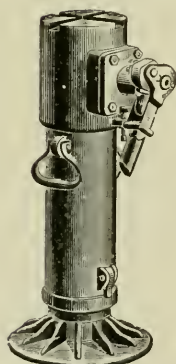
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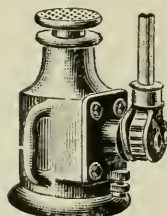
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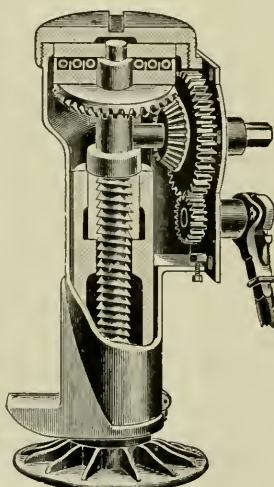
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Meetings held fourth Friday each month, except June, July and August.

**PROCEEDINGS OF MEETING,
DECEMBER 28th, 1906.**

The meeting was called to order at the Monongahela House, Pittsburgh, Pa., at 8:00 o'clock P. M. with President F. H. Stark in the chair.

The following gentlemen registered:

MEMBERS.

Bigham, C. G.	Murphy, W. J.
Brand, Thos.	McDonnell, F. V.
Brown, Geo. P.	McIlwain, J. D.
Bruff, J. C.	McMurray, G. W.
Chittenden, A. D.	McNulty, F. M.
Conway, J. D.	Obey, G. B.
Courson, Chas. L.	Peacock, W. W.
Curtis, H. C.	Peck, C. D.
Dunlevy, J. H.	Pfeil, John.
Edmonds, J. F.	Phelps, W. H., Jr.
Elder, Thos. W., Jr.	Porter, H. V.
Foller, Chas. S.	Reese, F. T.
Gauss, E. E.	Smith, D. W.
Gies, Geo. E.	Spangler, C. P.
Graham, Chas. J.	Stark, F. H.
Gurry, Geo.	Stucki, A.
Halleran, H. J.	Suckfield, G. A.
Hood, D. G.	Summers, E. W.
Howe, D. M.	Sweeley, G. P.
Huyett, E. G.	Tamkins, B. L.
Jennings, F. R.	Turner, L. H.
Kennedy, Jas.	Walker, Geo. G.
Kerr, J. K.	Warnock, H. R.
Knight, E. A.	Weigle, F. S.
Lanning, J. F.	Weisbrod, J. F.
Lobez, P. L.	Wendt, E. F.

White, Frank B.

VISITORS.

Alleman, C. W.	McKee, W. J.
Butler, J. W.	Nisbet, W. C.
Charles, John G.	Obey, J. B.
Hall, Wm. L.	Paxson, C. H.
Herran, J. E.	Phelps, K. T.
Mansfield, W. W.	McGraw, J. R.
Martin, P. A.	Smith, Sion B.
Mitchell, J. C.	Smith, W. E.
McKee, D. L.	Snyder, F. I.
McKee, William.	Taylor, W. E.

Whited, Willis.

The minutes of the last meeting being in the hands of the printer, the reading of them was dispensed with.

The Secretary read the following list of applicants for membership :

- O. F. Culbertson, Yard Master, P. & L. E. R. R. Co., 30½ East St., New Castle, Pa.
- Chas. O. Dorr, Paymaster, Monongahela R. R. Co., Brownsville, Pa.
- Henry F. Gilg, Secretary, Refined Iron & Steel Co., Lewis Bldg., Pittsburgh, Pa.
- N. P. Kyser, Chief Clerk Engine House, Penna. Lines, Freedom, Pa.
- William E. Maguire, Assistant Foreman Engine House, P. F. W. & C. Ry., No. 397 Pennsylvania Ave., Rochester, Pa.
- William J. Mawhinnay, Boiler Inspector, P. Ft., W. & C. Ry. Co., Freedom, Pa.
- Paul Muller, Pittsburgh Manager, Ernst Wiener Co., Gazette Bldg., Pittsburgh, Pa.
- S. N. Nickerson, Agent, Penna. R. R. Co., Hays, Pa.
- W. K. Patterson, Carpenter, Pittsburgh Coal Co., No. 512 Morrow Ave., Carnegie, Pa.
- Thos. Scott, Agent Bureau of Coke Statistics, P. R. R., Penna. Co., B. & O. R. R. and P. & L. E. R. R., Westinghouse Bldg., Pittsburgh, Pa.
- M. A. Smith, Foreman, P. & L. E. R. R. Co., Glassport, Pa.
- C. J. Symington, Sales Agent, T. H. Symington Co., Calvert Bldg., Baltimore, Md.

PRESIDENT: These applications will be acted upon by the Executive Committee, and if approved, the gentlemen will become members.

The Secretary read the following communication:

Montreal, November 12, 1906.

The Railway Club of Pittsburgh,

J. D. Conway, Esq., Secretary,
Pittsburgh, Pa.

Gentlemen: I herewith tender my resignation as Second Vice President of the Railway Club of Pittsburgh, to be effective from date. I regret it will be impossible for me to serve the Club owing to being transferred from Pittsburgh to Montreal.

Yours truly,

H. B. AYERS.

MR. L. H. TURNER: Out of courtesy to Mr. Ayers and in view of the fact that the duties of the Second Vice President are not very arduous, I move that we advise Mr. Ayers that his communication has been received, and his resignation is respectfully declined. And we can elect a Vice President at the next election.

Motion unanimously carried.

PRESIDENT: It gives me great pleasure to introduce to you Mr. Wm. L. Hall, representing the Government, who I know will edify and instruct us during the next hour.

MR. WM. L. HALL: Mr. President and Gentlemen: I want to tell you of the very great appreciation I have at the kind invitation you have given me to come before your Club for a discussion of the subject of woods used by railroads. It is a subject in which I am greatly interested and along the line in which my work happens to be. And for that reason I am especially glad to know that the railroad men of Pittsburgh are interested, too. I read a report of the meeting which you held in September in which a very interesting discussion took place on the use of metal cross ties. And I have learned since coming into the room tonight that in a meeting held since that time you have had another discussion in which the subject of wood supply was taken up.

In the September meeting, the report of which I read, the

general opinion seemed to prevail that the wood supply is getting scarce all over the country; but from the verbal report which I have just had of the more recent meeting, on the Pacific coast is a vast area of timber upon which the present annual cut would scarcely make any impression. My own view will fall somewhere between the two, if I may give you an idea of it before getting into my paper.

I have chosen as a subject

The Necessity of Economy in Railroad Uses of Wood.

BY WM. L. HALL, ASSISTANT FORESTER, U. S. FOREST SERVICE.

Railroads require for their use the highest quality of timber. In the specifications of the American Railway Engineering and Maintenance of Way Association the following requirements are stated for longleaf pine piles:

"Piles shall be cut from sound live trees close grained and free from wind and heart shakes, large or unsound knots, decay or other defects that will impair the strength or durability of the pile. No doubtful grades will be accepted. Piles shall be hewed square, except that one-inch wane will be allowed on two corners half the length of the pile. They shall not be less than 12 inches nor more than 14 inches at the large end and not less than 8 inches square at the small end. Piles having a bend not exceeding 4 inches in 20 feet, 6 inches in 30 feet, and 8 inches in 40 feet or over will be considered straight. No short crooks allowed. Piles must be hewed smoothly without deep score hacks. Piles shall show at least 75 per cent heart on face anywhere in their length."

A longleaf pine tree with an 18-inch diameter, 4½ feet above ground, which would be about the right size to furnish the required pile, is approximately 150 years old. A tree large enough to cut one 12-inch by 12-inch by 16-inch bridge stringer is 170 years old. Whether it is bridge timbers, piling, crossties, or lumber for car building, the railroads require the very best kinds of wood and the highest quality of those kinds.

The products required are the result of slow growth. White oak and longleaf pine, the favorite timbers for railroad construction, grow more slowly than any other timbers of their respec-

tive classes, and the best qualities of white oak and longleaf pine are found in those individual trees which have had the slowest and most regular growth. Because young trees of these kinds are so long in reaching marketable size is why it will be comparatively easy to exhaust the available supply of these timbers. Growth is a smaller factor in offsetting cutting than is the case in many other trees.

The demand upon these well-known construction timbers by railroads and also other industries has constantly increased. The supply, not greatly replenished by growth, has diminished year by year until there is at present shortage of white oak and an exceedingly heavy strain upon longleaf pine. How prices have risen during the past five years need not be pointed out to gentlemen who have been painfully in touch with their upward course.

The situation in brief is this: The railroads are large users of classes of timber in which there is an imminent shortage. Railroad construction is founded on the use of these timbers. Any change to other classes of wood or to other materials means experiment, the outcome of which is uncertain. But regardless of the outcome of experiments some change is inevitable. White oak can not be used when it does not exist.

Accepting the idea that there must be some change in the use of wood by the railroads, let us consider in what direction a satisfactory rearrangement seems most easily possible. In that direction experiments should be made. The problem is one of concern to both the railroad man and the forester, because both want to see wood used only where it is the best possible material. In my opinion Mr. J. A. Atwood was exactly right in your September meeting when, in speaking of railroad ties, he said: "If there is a large advantage on account of stability in service and safety by the use of steel ties over wooden ties, of course the steel tie is what you want. The railroads want perfect track as nearly as possible, and we can afford to pay whatever it costs to get the best track."

So far as wood is the most acceptable material in railroad work let us use it and let us bend our energies toward making safe an adequate supply of it. So far as its place can be filled

better by some other material let that material be adopted as rapidly as conditions will permit.

In car building I understand that wood is rapidly being supplanted by iron and steel in the construction of coal, tank and flat cars, and to some extent, in cars for passenger service. Box, stock and refrigerator cars, which form more than half the freight cars in use, are, according to my understanding, still made principally of wood. It is important that the railroads determine whether these cars can, with advantage, be made wholly or in part of steel rather than wood. If they can be so made then car shops should turn their attention to that form of construction. If they must be made of wood then we must mark down an item for the supply of which we must look to the forest.

Railroads use wood extensively in the construction of their station buildings and connecting approaches and platforms. From the viewpoint of an American desirous of the best things for his country and of a forester aiming to put wood to its highest use I want to say that I think the wooden depot with its attendant buildings and its setting of wooden walks and platforms has already outlived its usefulness, even in the smallest villages. Immediate economy undoubtedly has been the controlling factor in this kind of building, and were this use of wood alone involved, we should all surely welcome such a rise in the price of wood as would make it economical to use for station buildings brick, stone or concrete and for walks and platforms brick, gravel or cement. As railroads move toward permanence in track construction they can surely afford to move with equal or greater rapidity toward permanence in station construction.

In this connection let me ask attention to the possibility of employing some other material than wood in the flooring of wharves and docks. The best quality of wood is used in great quantities for this purpose and I believe that wood is about the only material used. Its substitution by some permanent material, if found possible, would seem highly desirable. If substitution is not practicable then would it not be advisable to use, instead of board flooring, a pavement of creosoted wooden blocks, with the blocks laid on end as in bridge and street pavement?

In bridge construction there is a general movement toward the replacement of wood with masonry or steel, even in

small structures. Steel and stone after thorough trial have evidently proved more acceptable materials. In spite of this tendency the Committee on Wooden Bridges and Trestles of the American Railway Engineering and Maintenance of Way Association claims that "It will be a very long time before wooden trestles cease to be used on most of our railroads." Without technical knowledge upon the subject, it has been my personal observation that the ballast-covered wooden bridge is a favorite form of construction on many railroads, and that change from it to more permanent types of construction is in many localities taking place very slowly. A large amount of high grade timber is used every year in bridge and trestle construction. This timber should be made as permanent as possible by preservative treatment. Such timbers do not as a rule wear out, they deteriorate by action of the weather and they decay. A treatment which makes them resist weather action and decay will correspondingly increase their service. Railroads in the West and South are treating bridge and trestle timbers quite extensively. Even when the South can no longer be depended upon for heavy timbers the railroads of the West will use bridge timbers in great quantities.

The wooden pile is an article which, so far as I am informed, has not been successfully substituted. Regardless of what may be done to replace wood in other places it seems that the wooden pile must remain in favor indefinitely. A vast quantity of timber is annually cut for piling, and the worst of it is that these fine poles—the best product of the forest—have often vanished within a few months before the onslaught of marine borers when placed in brackish water, or they have decayed within a few years in situations favorable to the growth of injurious fungi. With rising prices we are passing out of conditions which have made such methods practicable. We must use wooden piles but we cannot afford to place them at great expense and then allow them to be immediately consumed by insects or fungi. They must be protected. Experience has taught that the best protection against both insects and decay is a thorough impregnation of creosote. A good quality of creosote stays in the wood indefinitely, and so long as it is there in sufficient quantity neither borers nor fungus will attack it. In economizing in the use of wooden piles, then, we must look, not to substitution, but to the continued use of wood with the best possible protection.

Another class of railroad timbers which must be considered is made up of telegraph poles and fence posts. These must be had in considerable quantities and the only satisfactory material from which to make them is wood. As in the case of the wooden pile the problem is one, not of substitution, but of protection. Unlike the pile, the telegraph pole and the fence post require protection only for a few feet at the ground end. Decay takes place in a damaging manner only over that part from a few inches above to a few inches below the surface. That is the only part which it is vitally necessary to treat. This simplifies the problem of treatment in one way but complicates it in another. It makes it possible to use less of the preservative, thereby reducing expense, but it makes necessary equipment not found in the ordinary treating plant. Without stopping to discuss the detail of operations, however, which it is not the purpose of this paper to present, let me say that the Forest Service has made careful and extensive experiments in the butt treatment of both poles and posts and the results warrant belief that it is entirely practicable. With relatively small expense a penetration of one-half inch to two inches can be secured. One telephone company is already taking up this form of treatment and probably within a few years it will be in common use.

In the question of railroad ties I know that this club is vitally interested. No feature of the shortening timber supply is being discussed today with more seriousness than the scarcity of ties.

On the basis of reports from railroads representing 97.1 per cent of the trackage of the country the Forest Service found the total number of ties purchased by steam roads in 1905 to be 81,500,000; 18.5 per cent of which were used for new track and 81.5 per cent for renewals.

Oak, principally white oak from the Central and Southern States, furnished 49.5 per cent of these ties. Pine ranks next in importance with 23.5 per cent, and while it cannot be definitely stated what proportion is to be assigned to the different kinds of pine, it is shown from the reports that more than three-fourths are of Southern yellow pine. White and Norway pine should be credited with from 3 to 4 per cent and the Western yellow pine of the Rocky Mountain and Pacific Coast regions with from 17 to 18 per cent. Cedar ranks third with 8.9 per

cent. followed closely by chestnut with 6.1 per cent. Both of these species are excellent tie woods and would figure more largely in the total production were it not for the limited distribution and supply of each.

Statistics are lacking for a comparison of the present output of ties with the number from each kind of timber in other years, but it is very probable that were they available it would be shown that the number and proportion of the pine ties have increased materially within the last decade. Correspondingly, the proportion of oak ties would doubtless show a decrease for the same period.

The four leading kinds of timber for ties are oak, cedar, and chestnut, which combined furnish 83 per cent of the total number, oak and pine alone furnishing 68 per cent. Next in rank is the red fir of the Pacific Coast and Rocky Mountain region with 4.6 per cent, followed by the cypress of the South with 4.5 per cent. The tamarack, or eastern larch of the New England and Lake States, and the eastern hemlock are the only other species credited with more than 1 per cent of the total number. Beech, birch, and maple were reported in amounts of less than one-tenth of 1 per cent each. The miscellaneous classification includes a number of woods, among which the most important are red gum, black locust, elm, hickory, and red cedar. Thus some twenty kinds of timber enter into the production of railroad ties, but of these only seven at present are important.

This statement shows that a strong tendency toward the use of other woods than oak, cedar and chestnut has already set in. Had we the figures, the increased proportion of southern pine would unquestionably be surprising. Several other woods of the list will furnish greatly increased figures within the next few years. Red fir, cypress, tamarack, hemlock, redwood, and western larch have the properties of good tie timbers.

In your September meeting one of the members of this Club, in discussing the merits of steel and wooden ties, said:* "While I believe that the best tie is a first class white oak tie, 7" thick, 9" face, 8' 6" long treated with some preservative, yet we all know that such ties are very scarce and the railroads are about facing the problem of purchasing ties of other material than

* Mr. Edwin F. Wendt.

wood. We need not stop at this time to state just why an oak tie is better than a steel tie. The reasons are many. The superiority of white oak ties is generally recognized by railway engineers in charge of maintenance of way, and the advocates of steel ties do not deny this superiority. The purchase of steel ties is being advocated because timber cannot be procured in sufficient quantities to supply the demand for cross ties. It is no longer possible in the United States to purchase 80,000,000 first class cross ties per year. The supply of durable timber is inadequate."

If the first class white oak tie has such manifest advantages over the steel tie I am not certain that we must decide for the latter because white oak is growing scarce. It should be decided first whether other woods can be so protected and used as to obtain the serviceableness of white oak.

Railroad practice is working in this direction. Tie plates have been introduced with marked success on many roads for the protection of soft wood ties. A very great advance is being made just now toward the preservative treatment of ties. Ten per cent of the ties used last year were treated. All efficacious treatment helps because it largely eliminates decay, which has been the greatest factor in weakening ties. There is ground for believing that by certain forms of creosote treatment the tie can be both hardened and strengthened. The form of spike can be bettered so that the union between the tie and rail will be firmer, and the tie thereby protected. The better ballasting of the track will also protect the tie.

My point is this: These means of protection will bring the tie of other woods approximately to the white oak standard, and all these means of protection can be accomplished by most railroads more easily than they can change to the steel tie.

If we change from the wood to the steel tie we should do so only because all around steel is the best material for the purpose. If steel or concrete or any other material actually proves better than wood then that material ought to be adopted. If wood remains the most acceptable tie material we ought not to discard it on the ground of present scarcity.

One point regarding the supply of wooden ties should be carefully borne in mind. Present scarcity does not necessarily mean future exhaustion. A mineral once exhausted can never be

replaced. A forest can be grown anew out of the ground. It is, therefore, a safer thing in the long run to depend upon.

Timber is at present scarce and it will become still more scarce inside of twenty years. But the timber regions of this country are well distributed, are great in area, and are of immense potential productiveness. With reasonable protection and care the forests will produce all the wood which will be needed even for the ultimate industrial development of the country.

In my opinion the present situation is to be met, not by hastily abandoning wood in favor of some other material of unproved acceptability which may also in time become scarce. The situation is to be met first, by the use of other materials where we know they are better; second, by the best possible protection to the wood where it proves the best material; third, by protection and care of the forest in order that nature, by its own process of growth, may, through all time to come, supply the wood needed by the industries.

PRESIDENT: This has indeed been a very interesting paper, and we want to draw out from our friend, Mr. Hall, further information. We want to turn this into a sort of question box. In order to get the subject before you I will ask Mr. Wendt, Assistant Engineer of the P. & L. E., to open up the discussion.

MR. E. F. WENDT: I was just about to arise to say that Mr. Thomas Johnson, consulting engineer of the Pennsylvania Lines, sits in front of me and he is so much better able to open the discussion than I, that I hope you will ask him to give us some of his experience.

MR. THOMAS JOHNSON: Mr. President and Gentlemen: I do not know that I have anything to add to the interesting paper which Mr. Hall has given us, but I would like to ask a question. When he was talking of the treatment of bridge timbers whether he had considered the fact that creosoted timber is much more inflammable than the untreated wood, and for bridge purposes might become an element of danger.

MR. WM. L. HALL: That is a mooted question. Last winter it was necessary to get the best information we could find on the inflammability of creosoted timbers, and I wrote to

all I could hear of who had had experience with creosoted timber in fires. There were places where cities had burned and there were creosoted poles up along the streets, and there were places where creosoted timbers were used in docks and the docks had burned. And while all of those who answered, and a number of them were railroad engineers, did not agree, the consensus of opinion was that creosoted timber, at least after it has stood a while, is much less inflammable than uncreosoted timber. One man brought out the point, and I believe it is a strong point, that creosote as an oil contains many things, some of which are much more readily inflammable than others, and you discover that a certain amount of oil comes out at very low temperatures and a certain amount stays in at very high temperature. It was the opinion of this man that creosoted timber after it stood a while after creosoting lost the more inflammable substances while the heavier substances with higher ignition point stayed in the timber, and therefore it became less inflammable after it stood a while than the uncreosoted timber. As a rule, speaking of bridge timbers, if you exclude the first few weeks after the timbers are treated with creosote, you have a timber which is very much less likely to burn than if it were untreated.

MR. E. F. WENDT: The white oak family includes a very large number of different varieties, and the red oak a very large number. What in your judgment is the relative value of the red oak, pin oak, black oak, etc., in relation to white oak in point of durability for railroad purposes?

MR. WM. L. HALL: Without any treatment I do not think the red oak tie is nearly equal to the white oak tie. If a white oak tie will last six to eight years, I think you may expect a red oak to give out in from three to five. Not because of strength—it is nearly as strong as white oak—but because it does not resist decay.

PRESIDENT: How about the treated oak tie?

MR. WM. L. HALL: The treatment brings the red oak tie practically up to the standard of the white oak tie. With timbers grown under about the same conditions there is no great difference in strength.

MR. THOMAS JOHNSON: In our efforts or experiments

in the direction of treated ties, it has always been maintained that they could not get enough of the protective material into white oak, while they could get a very much larger quantity and better penetration in red oak. For that reason we have never had any white oak treated but we have had quite a number of red oak ties treated—not with creosote, however, but with another process.

MR. WM. L. HALL: There is a very distinct difference in the way in which they take treatment. White oak is a pretty difficult timber to treat, and so far as I know it has not been treated anywhere in large quantities. I may say that all of our timbers differ in the way in which they receive treatment. Yet we have found that with any timber if we work with it and get to understand it we can usually treat it. And I have no doubt that we can by careful work find a means of treating white oak, though perhaps never so thoroughly as red oak.

MR. E. F. WENDT: I followed the paper of the evening with a great deal of interest and it is worthy of careful reading as well as attentive hearing. The question is a very lively one at the present time because of the difficulty in purchasing timber in railway business, whether in the car department or the maintenance of way department. It was interesting to hear the handicaps of the telegraph line. The telegraph line is a great bother sometimes to the railroad. It seems to me that the ideal telegraph line of the future will be under ground and there will be no poles to purchase. Furthermore, in the M. of W., wooden bridges are no longer so much in evidence, concrete having taken the place of timber to a considerable extent. In relation to the tie question I believe everything the speaker has said. At the same time if he were up against the problem of purchasing 500,000 cross ties by tomorrow he might modify his views slightly—not theoretically or with relation to what might be done some years hence, but with relation to the present conditions. It is certainly difficult to purchase cross ties for the Pittsburgh railroads in sufficient quantities rapidly enough to keep the work moving. I have no doubt of the truth of the statement that when the American people wake up to their extravagance in relation to the forests and set about to exercise economy and to apply the advanced methods of treatment and become more

interested in the growth of timber, we will be able to utilize these inferior timbers. But at the present time in this city treated timbers are hardly in the market. An instance occurs to me where a small quantity of treated timber was wanted and it could not be purchased for months to come.

It was interesting to note that about 80,000,000 cross ties are used every year, and about 50 per cent are oak, 25 per cent pine, 10 per cent cedar and 5 per cent chestnut. The problem which confronts the railroads today is how to get ties now, not 25 years hence. The government has only begun to promote this forestry work. So it occurs to me that the thing for the railroads to do is to meet the present conditions by purchasing what is set before them and encouraging the processes of preservation, and at the same time to protect themselves against the future by considering all the substitutes for timber which are in the market. Like a great many other things they are said to be panaceas for all the ills of the railroad man's business, and like many other remedies they will be found somewhat worthless. But the person who neglects to give a careful study to all these substitutes will make a mistake. At the same time I think the speaker is entirely correct in his statement that the inferior woods can be made useful. The question is a live one and I think we are under great obligation to the speaker for the very excellent and instructive paper.

MR. F. J. REEVE: If I understood the gentleman correctly he said we should first be sure that steel was better for construction of our cars than wood, and also seemed to think that for a number of years yet to come we would not suffer to any great extent for want of timber. I would like to have him tell us something of what the Bureau of Agriculture is doing in the way of propagating new forests or new supplies of timber.

MR. WM. L. HALL: It is difficult to answer that in a word, but I will do it in as few words as I can. The main work of the Government toward making sure and improving the future timber supply has been done in the West, because we had the opportunity to do it there first. In the Western States the Government had retained control of a vast amount of land, a large area of which was and is today forest land. And the

best thing that has ever been done by the Government toward the protecting of the forests is the reserving of large parts of the forest lands of the West permanently for forest purposes. They are not to be homesteaded or taken up in any form. They are reserved for timber production. There have now been reserved about 127,000,000 acres in the territory west of the Mississippi, and mostly in States of the Rocky Mountains and west of them. Of this, perhaps half is covered with timber of some value at the present time; a great deal of it has been burned and ruined in that way; and much of it has been cut over. It is all forest land properly speaking. These lands are being protected from fire, protected in the cutting, so that a continuous stand of forest will be kept up. In addition there is a large timber supply around Puget Sound, of which you heard at your last meeting, so that the timber supply in the West for some time to come will not be a very serious problem. With the start we have there in handling the forest in the proper way it may never become serious.

But when you come east of the Mississippi River it is entirely different. Here are all the great industries using timber and here all the land has passed out of the control of the Government. Most of it has been cut over or ruined by fire, so that what timber we have now, except in the South, is second growth, pretty badly cut over, and not of good enough quality to furnish any great quantity of timber such as the railroads use. The question of what is to be done in the East is the important one. Those who have thought most on the problem are of the opinion that the general Government has got to take up the forestry question in the East, just as it has done in the West, that is, it has got to take over certain land in the Appalachian region and begin to handle that forest with all the care that is necessary to keep it productive. But that entails buying it, for the Government does not own the land. There is a bill in Congress now which appropriates \$3,000,000 for the buying of such lands and we hope it may pass, because the Federal Government is the institution that will have to take the lead in this. The question reaches so far into the future that we cannot expect the private land holder to take it up on his own account. But I do think and I am glad to have this opportunity to say that the great railroad systems such as we have in the eastern half of the United

States, should right now begin the getting of land for their own timber supply of the future. The railroads we have now are fairly permanent. They change more or less in organization, but still they will be operating without doubt 50 or 100 years from now. And I think such organizations should at once begin to make provision for a supply of timber in the future. It seems to me the best kind of policy for the railroads to be giving attention just now to the organization of timber departments and the getting hold of timber lands. When they have gotten them they should handle their timber lands with all the care that is necessary to keep the forests protected from fire and to keep the growth coming on, and if need be begin planting. Certainly we shall have to begin planting at many points. First of all, the railroads should decide what timber they will have to use. Then they should propose to grow this timber, and having grown it they should protect it just as much as possible by preservative treatment. And to that end the railroads ought to establish treating plants. You cannot buy treated timber in the market. Treating plants are worked to their utmost capacity all over the country, and while many new plants are being built yet the contracts, I know, are made for months in the future. It is a matter which railroads will have to take up for themselves. There are now ten or more railroads of the country which have their own treating plants and many more should have them. That is the first point.

MR. WILLIS WHITED: Has any private corporation in this country attempted to acquire large areas of land suitable for raising timber and establishing proper police protection against fire and against thievery and to replace the unsuitable kinds of timber by desirable kinds so that as much of the area as possible will be producing valuable timber; or to acquire land that is already yielding timber and cutting it away, and as fast as it is cut away, see that it grows up again with valuable timber, cutting away worthless and replacing with good ones as rapidly and as thoroughly as possible? In other words, is forestry being carried on on business and scientific principles so that the ownership of that timber land can be continued as a permanent profitable business proposition? Has that been attempted to any extent in this country by private corporations, railroads or others, and is it done to any extent abroad?

MR. WM. L. HALL: It has not been done by private individuals to any great extent in this country. But you have described exactly what practical forestry is. It is the continual use of the forest but the continual outlook for its future productiveness. Forestry is being practised abroad both by governments and by individuals under government supervision. It is not being done very much in this country. Some attention is being given now to fire protection, but considering the whole country not very much is being done on private land. For the most part the private lumberman is going on the same plan he has always gone on, except that he is using his timber supply a little more closely.

MR. W. E. TAYLOR: Isn't this 127,000,000 acres of timber reserve rather detrimental to lumbering interests? Is it not a fact that not more than 2 per cent of the virgin growth has been cut out of the virgin timber and at the present time there is timber going to decay that should be cut down and utilized?

MR. WM. L. HALL: We are using it, it is being cut.

MR. W. E. TAYLOR: Isn't it a fact that it is a question for the people whether it will be a case of Government ownership of the lumber industry, or Government ownership of the railroads first?

MR. WM. L. HALL: We have not worked it out that far.

MR. W. E. TAYLOR: I was out in the center of Clearfield County recently and I said to a man up there: "Who owns all this waste land?" "The coal companies and the railroads." "What are they doing with it?" "Unloading it back on to the State."

PRESIDENT: Can you tell us briefly something about contagion of trees, disease passing from one tree to another, and the necessity of burning up the rubbish and doing away with this timber to avoid contagion of disease to good trees?

MR. WM. L. HALL: We find that great damage to forests comes from insect attack. There have been cases where certain insects multiplied in one locality and practically ruined large areas of timber. There is now in the Black Hills of South Dakota a bark borer which has killed many hundred million feet of first class pine timber. I believe it is also working quite extensively throughout the Rocky Mountain region. Insects do

great damage at times in nearly all forests. As a rule the forest which is lumbered according to the old-fashioned rule is left in the worst possible condition for insects and fungus growth, because a lot of material is on the ground and even if fire runs through, not all of it is destroyed and there is a great deal of stuff which harbors insect life. The more careful system of lumbering, which is practical forestry, will do away largely with the loss now sustained through insects and fungus attack. However, fungus diseases are not as disastrous in their effect on growing forests as they are upon the wood after it is cut.

PRESIDENT: Has there ever been any estimate made as to the quantity of standing timber today as compared with 25 years ago, and the percentage of new timber that has been growing during that time?

MR. WM. L. HALL: There is no estimate of any value on that. There have been guesses. We are now considering the possibility in the next decennial census of trying to get an estimate of the merchantable timber of the country. Scattered as it is, it can hardly be taken up in any other way than with the ordinary census, and so far no censuses have taken it into account.

PRESIDENT: Why is it that in the West, where timber is more abundant and cheaper, treating plants are more extensive than in the East, where timber is more scarce and costs more?

MR. WM. L. HALL: The greatest number of treating plants is found in the South, along the Gulf and in the region of New Orleans. Then, a number of railroads, particularly the Western railroads, have plants of their own. The bulk of the earliest treatment was done by those railroads which were built through the plains where timber was scarce and they had to pay high prices for it. The timber which they found, especially in the Rocky Mountains, was pine, which decayed rapidly. Naturally they turned to treatment first in that region. In the East were white oak, chestnut and cedar, which are fairly durable timbers. As I recall now, there is not a railroad which crosses the arid country which has not its own treating plant and treats its ties as a policy. The last to adopt the policy was the Northern Pacific.

PRESIDENT: Mr Turner, can you tell us whether metal is a good substitute for freight cars?

MR. L. H. TURNER: We think it is. The speaker does not seem to be very well informed as to the extent of the use of steel in the construction of cars. I think it is safe to say today that one-half of the new cars under construction are being built of steel.

MR. WM. L. HALL: Is that true of box cars?

MR. L. H. TURNER: Not altogether.

MR. WM. L. HALL: Is it true to any extent?

MR. L. H. TURNER: In all probability in a short time it will be. They are now building steel passenger cars, and if practicable in passenger cars, certainly in freight. Railroads in bridge and car construction are certainly replacing wood very rapidly with steel.

PRESIDENT: Mr. Stucki, what proportion of box cars being built have the steel underframe or steel frame with wood upper-structure?

MR. A. STUCKI: I am really not prepared to state the exact proportion of the steel underframe cars built today, but it is certain that this type will dominate before long. It may also be stated that there are several plants now in course of construction for just that kind of a car. This would include box, refrigerator, stock and composite gondola cars.

The next step is a box car with a steel frame all the way through, using simply wooden siding, lining and floor. Some of these cars have already been built, but since the frame is hidden from view it is hard to distinguish them from a wooden frame car.

I now would like to emphasize one point, which Mr. Hall has brought out in regard to the connection between rail and tie, and I think this is especially important in order to prolong the life of a wooden tie. It is clear that by having a good fastening, such as screw spikes, the vibrations of the rails will be transmitted to the tie without allowing any motion between the two and without causing any abrasion of the tie at a place where the bearing surface is small, i. e., under the rail; in other words, the rails and ties will vibrate together and the abrasion is bound to take place between the tie and the ballast and will naturally be very small on account of the large bearing surface present. This point should not be overlooked.

May I also ask Mr. Hall why they used a triangular tank in treating the bottom end of those telegraph poles instead of an ordinary rectangular tank?

MR. WM. L. HALL: Simply because for the experimental test we had it was simpler to operate. We could not handle the poles very well standing up. A 30 foot pole would weigh several hundred pounds. We could handle it in that triangle better and we got better results. If that goes into actual practice I doubt whether it will be with a tank of that shape; that is simply a question of means to be worked out when the principle is put into operation.

MR. GEO. E. GIES: I would like to ask Mr. Hall what success they have had in the treatment of yellow pine, to what depth do they get the preservative, and also what has been found in regard to the strength between virgin longleaf yellow pine and a tapped tree in regard to strength, what are the statistics on that?

MR. WM. L. HALL: The treatment of heart longleaf yellow pine, so far as I know, has never been accomplished successfully as yet. You can treat the sap portion of the longleaf pine. When it comes to the loblolly pine, which is also a yellow pine and sold right along with the long leaf, you can treat that pretty fully, even the heart. So there is a difference between the two kinds of timber.

In relation to the difference in strength between the tapped or bled longleaf pine as compared with the natural untapped wood, tests were made about ten or fifteen years ago in which it came out that the tapping had not influenced the strength at all. The tapped tree was just as strong as the untapped tree so far as the tapping was concerned or had any influence.

A VOICE: I would like to ask whether the present study of forestry is not more a study of climatic conditions and influences than it is to take care of the lumber of the country?

MR. WM. L. HALL: The law which provides for the forest reserves of the West provides for them on just two grounds, first, a protection of the water supply, and second, for the protection of the wood supply. The question of climate does not come in at all. But as you know, the forest on the mountain slope, particularly in the West where water is very valuable

for irrigation purposes and for all purposes, is very valuable. But those are the two reasons given in the law underlying the forest reserve policy, the protection of the water supply and the protection of the timber supply.

A VOICE: What difference is there between the longleaf yellow pine and the short leaf in strength and also after it is cut down across the grain what is the difference?

MR. WM. L. HALL: No, it is not altogether a difference in growth. Some pieces of the wood cannot be distinguished by sight. There are certain pieces of longleaf pine you know absolutely are longleaf and certain pieces that you know are loblolly and short leaf. And then there are pieces that I do not believe anyone can classify with certainty. Longleaf pine is a dense wood, it makes a slow growth and consequently there are more rings to the unit of measurement than in either the loblolly or the short leaf. Then there is another difference. In the cross section of a stick of timber you know there is a zone of heartwood and a zone of sapwood. We find that the longleaf pine has usually a much greater growth of heartwood than either loblolly or short leaf.

MR. E. W. SUMMERS: I would like to ask to what extent spruce and hemlock are used by the railroads today, and what is the comparative value of those woods with yellow pine and other woods spoken of for all kinds of railroad work? And further whether there is much of that timber in the country, in the Eastern section?

MR. WM. L. HALL: Of hemlock ties there were cut last year 1,713,000 and of spruce there were cut 148,000. Through New England spruce is one of their standard timbers for construction, and I suppose it was there that the spruce was used for ties also. And I understand it is a timber of some durability, though not equal to white pine. Hemlock is a timber that has come into a wide acceptance in the last few years. It is being used for a good many purposes and I do not see why it might not be a useful timber and valuable in car building, though I do not know the peculiar properties which are necessary to woods used in car building. There is a large lot of hemlock on the Pacific Coast and it is all practically untouched. Dinglas fir has been thought the best timber there and I suppose it is the best

timber, but hemlock is a very good timber. We believe it is a little better than the Eastern hemlock, and there is a very large amount of it, so that within the next few years you will see a good deal of hemlock coming from the Pacific coast. What has been coming from there has been sold mostly under other names. I believe the name gray fir is the one that is commonly applied.

PRESIDENT: Will the Panama Canal make it possible to get it here at a much less cost?

MR. WM. L. HALL: I can not tell as to that. I suppose it will make some difference in the transcontinental transportation question. At the present time the difficulty in getting Western woods is the difficulty of transportation.

MR TURNER: This is one of the most interesting subjects that have ever been discussed before this Club, and it was certainly well presented. And I wish to offer a resolution that this Club extend to Mr. Hall thanks for his kindness in coming here and giving us the benefit of his information.

The motion, being duly seconded, was carried unanimously.

There being no further discussion,

ON MOTION, Adjourned.

By permission we present in full copy of Circular 43, which no doubt will be of interest, as the subject matter bears close relation to Mr. Hall's very able paper:

United States Department of Agriculture,

FOREST SERVICE—CIRCULAR 43.

GIFFORD PINCHOT, FORESTER.

CROSS-TIES PURCHASED BY THE STEAM RAIL- ROADS OF THE UNITED STATES IN 1905.

BY H. M. HALE, FOREST ASSISTANT.

The following report upon the cross-ties purchased by the railroads in 1905 is based upon statements from 770 steam railroad companies. Of those which failed to report, only one operates more than 1,000 miles of track, and that one less than 1,300.

The average mileage of the remainder is approximately 45. The total mileage unreported is 8,671. Since the total trackage in the United States on January 1, 1905, was, according to Poor's Manual, 293,937 miles, the unreported trackage amounts to but 2.9 per cent of the total.

In presenting this report the Forest Service desires to acknowledge the hearty co-operation of the officials of the various companies throughout the United States in furnishing the necessary data.

These statistics do not necessarily represent the number of cross-ties used in 1905, since they are compiled from the statements of ties purchased. However, there is but little doubt that the law of averages applies sufficiently well in this instance to warrant the assumption that the total represents, with a very fair degree of accuracy, the actual number of ties laid.

PRODUCTION.

The total number of ties reported is 77,981,227, switch ties being reduced to an equivalent number of cross-ties. Of the total number of ties purchased, 14,459,521, or approximately 18.5 per cent, were for use in the construction of new track, leaving 63,521,706 for renewals. It will be noted that this is less than the total announced in the preliminary statement made by the Forest Service under date of May 17, 1906. This is the result of a correction for duplication made in compiling the preliminary report. Assuming that the unreported 2.9 per cent of trackage required ties in the same proportion as the reported trackage, the total number of ties purchased by the steam railroads of the United States in 1905 was 81,562,150. Estimating 10,000,000 additional ties for the electric lines, the total number of ties purchased last year in the United States was, in round numbers, 91,500,000.

Table 1 shows the average cost and the total value of the various kinds of ties. The values given are based upon reports of representative roads in each region and are for ties delivered on the right of way.

TABLE 1.—*Value of ties purchased by steam railroads of the United States in 1905.*

Kind of wood.	Number.	Average cost per tie.	Total.
Oak.....	34,677,304	\$0.55	\$19,072,517.20
Pine.....	18,351,037	.42	7,707,435.54
Cedar.....	6,962,827	.44	3,063,643.88
Chestnut.....	4,717,604	.48	2,264,449.92
Red fir.....	3,633,276	.33	1,198,981.08
Cypress.....	3,483,746	.33	1,149,636.18
Tamarack.....	3,060,082	.36	1,101,629.52
Hemlock.....	1,713,090	.33	565,319.70
Redwood.....	590,852	.20	118,170.40
Western larch.....	311,150	.45	140,004.00
Spruce.....	148,168	.35	51,858.80
Birch.....	35,500	.40	14,200.00
Beech.....	34,227	.40	13,690.80
Maple.....	25,500	.40	10,200.00
Miscellaneous.....	236,894	.48	113,709.12
Total.....	77,981,227		36,585,446.14

Table 2 gives, by species, the number and per cent of hewed and sawed ties purchased during 1905.

TABLE 2.—*Ties purchased by steam railroads of the United States in 1905.*

Kind of wood.	Hewed.			Sawed.			Total.	
	Number.	Per cent of all ties of kind.	Per cent of all hewed ties.	Number.	Per cent of all ties of kind.	Per cent of all sawed ties.	Number.	Per Cent.
Oak.....	30,296,498	87.4	50.2	4,380,806	12.6	24.9	34,677,304	44.5
Pine.....	11,799,435	64.3	19.5	6,551,602	35.7	37.2	18,351,037	23.5
Cedar.....	4,842,651	69.6	8.0	2,120,166	30.4	12.6	6,962,827	8.9
Chestnut.....	3,252,046	68.9	5.4	1,465,558	31.1	8.3	4,717,604	6.1
Red fir.....	1,410,215	39.0	2.3	2,223,061	61.0	12.6	3,633,276	4.6
Cypress.....	3,095,760	88.9	5.1	387,986	11.1	2.2	3,483,746	4.5
Tamarack.....	3,049,972	99.7	5.1	10,110	.3	(a)	3,060,082	4.0
Hemlock.....	1,599,283	93.4	2.6	113,807	6.6	.6	1,713,090	2.2
Redwood.....	500,904	84.8	.8	89,948	15.2	.5	590,852	.8
Western larch.....	247,425	77.9	.4	63,695	22.1	.3	311,120	.4
Spruce.....	60,190	40.6	.1	87,978	59.4	.5	148,168	.2
Birch.....	25,500	71.8	.1	10,000	28.2	(a)	35,500	(a)
Beech.....	6,020	17.9	(a)	28,207	82.1	.1	34,227	(a)
Maple.....	25,000	98.0	.1	500	2.0	(a)	25,500	(a)
Miscellaneous.....	187,942	79.3	.3	48,952	21.7	.2	236,894	.3
Total.....	60,398,841	b77.4	100.0	17,582,386	b22.6	100.0	77,981,227	100.0

(a) Less than one-tenth of 1 per cent.

(b) Per cent of all ties.

The table shows that oak, the greater part of which is doubtless some variety of white oak, furnishes 44.5 per cent, or almost one-half, of the total number of ties. Assuming that the average tie contains 30 feet, board measure, the amount of timber represented by the white oak ties is over one billion board feet, or approximately one-fourth of the total amount of oak lumber pro-

duced in one year, according to the Twelfth Census. Nearly all of the oak is converted into hewed ties, only 12.6 per cent being sawed.

Pine ranks next in importance, with 23.5 per cent, and while it can not be definitely stated just what proportion should be assigned to the various species, it is certain that more than three-fourths of the pine ties are southern yellow pine. The white and Norway pines should be credited with from 3 to 4 per cent and the western yellow pine of the Rocky Mountain and Pacific Coast regions with from 17 to 18 per cent. These estimates are deductions from Table 3, which shows the number of pine ties which come from each region. Cedar ranks third with 8.9 per cent, followed closely by chestnut with 6.1 per cent. Both of these species are excellent tie woods and would figure more largely in the total production were it not for the limited distribution and supply of each. The percentage of the total number of hewed and sawed ties is, hewed, 77.4; sawed, 22.6.

Statistics are lacking for a comparison of the present output of ties with the number from each kind of timber in other years, but it is very probable that were they available it would be shown that the number and proportion of the pine ties have increased very materially within the last decade. Correspondingly, the proportion of oak ties would doubtless show a decrease for the same period.

The four leading kinds of timber for ties are oak, pine, cedar and chestnut, which combined furnish 83 per cent of the total number, oak and pine alone furnishing 68 per cent. Next in rank is the red fir of the Pacific Coast and Rocky Mountain region with 4.6 per cent, followed by the cypress of the South with 4.5 per cent. The tamarack, or eastern larch of the New England and Lake States, and the eastern hemlock are the only other species credited with more than 1 per cent of the total number. Beech, birch, and maple were reported in amounts of less than one-tenth of 1 per cent each. The miscellaneous classification includes a number of woods, among which the most important are red gum, black locust, elm, hickory, and red cedar. Thus some twenty kinds of timber enter into the production of railroad ties, but of these only seven, at most, are important.

SUPPLY.

Until a comparatively short time ago the railroads were usually able to secure an ample supply of ties from lands adjacent to their rights of way. This has been especially true of the vast network of lines which traverse the territory east of the Mississippi River. While this source is by no means exhausted, it has become seriously depleted, and where in former years the purchasing agent could contract for an almost unlimited number of white-oak ties with the assurance that they would be promptly furnished, at the present time it is necessary to contract for small quantities and to anticipate the demand far in advance.

Wherever the whole tree is worked up into ties, sawing permits of by far the closer utilization of material. From this it might be inferred that the present practice of hewing the majority of the ties is poor policy, judged from the standpoint of economy. As a matter of fact, however, little of the material which is converted into hewed ties is saw timber, consisting, as it does, of tops left from lumbering both conifers and hardwoods, or small trees from which, even though sawed, little, if any, additional tie stock could be secured, and heart timber full of knots, shake, and similar defects.

Where the tie was once the major product, it is now generally a minor product. The Pacific Coast is practically the only region in the United States where ties are produced as a major product of the forest. One of the most important sources of the ties in the East is the farmer's woodlot. During the winter in this region large numbers of ties are hewed and hauled to the railroads.

In determining the geographical distribution of the regions of supply, it was found impractical to attempt a classification by States on account of the manner in which the railroad companies furnished the information on this item. It was found possible, however, to determine the source, with a degree of certainty, by grouping the States as follows:

<i>Region.</i>	<i>States included.</i>
Southern.....	Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, Texas, Indian Territory.
Central.....	Ohio, West Virginia, Kentucky, Tennessee, Indiana, Illinois, Missouri.
Lake.....	Michigan, Wisconsin, Minnesota.
North Atlantic....	New England States, New York, Pennsylvania, New Jersey, Delaware, Maryland.
Pacific Coast.....	Washington, Oregon, California.
Rocky Mountain..	Montana, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico.

Table 3 shows, for the various regions, the number of hewed and sawed ties obtained from each kind of timber, arranged in order of importance. The regions are arranged from left to right according to the number of ties purchased.

TABLE 3.—*Source of supply of ties purchased by steam railroads of the United States in 1905.*

Kind of wood.	Regions.					
	Southern.		Central.		Lake.	
	Hewed.	Sawed.	Hewed.	Sawed.	Hewed.	Sawed.
Oak.....	11,406,130	570,806	14,554,592	2,966,758	240,824	101,823
Pine.....	10,197,766	4,182,193	10,400	18,600	641,941	2,420
Cedar.....		700			4,400,305	1,744,937
Chestnut.....	114,192	9,145	155,632	22,608		
Red fir.....						
Cypress.....	3,087,960	386,986	7,800	1,000		
Tamarack.....					3,026,193	6,491
Hemlock.....					1,556,421	44,278
Redwood.....						
Western larch.....						
Spruce.....						
Birch.....	25,000		500			
Beech.....	2,500		2,000	1,500		2,000
Maple.....	25,000			500		
Miscellaneous.....	15,237	3,460	15,781	11,199	40,935	5,519
Total.....	24,873,785	5,153,290	14,746,705	3,022,165	9,906,619	1,907,468
Per cent of all ties purchased in region.....	82.8	17.2	83.1	16.9	83.9	16.1
Total of hewed and sawed.....	30,027,075		17,768,870		11,814,087	
Per cent.....	38.5		22.8		15.1	

TABLE 3.—*Source of supply of ties purchased by steam railroads of the United States in 1905.*

Kind of wood.	Regions						Total.
	North Atlantic		Pacific.		Rocky Mountain.		Hewed and Sawed.
	Hewed.	Sawed.	Hewed.	Sawed.	Hewed.	Sawed.	
Oak	4,094,952	741,419					34,677,304
Pine	3,137	2,000		1,254,125	946,191	1,092,264	18,351,037
Cedar	412,505	323,176	29,841	25,163		26,200	6,962,827
Chestnut	2,982,222	1,433,805					4,717,604
Red fir			216,696	2,190,581	1,193,519	32,840	3,633,276
Cypress							3,483,746
Tamarack	23,779	3,619					3,060,082
Hemlock	42,862	69,529					1,713,000
Redwood			500,904	89,948			590,852
Western larch			22,730		224,695	63,695	311,120
Spruce					60,190	87,978	148,168
Birch		10,000					35,500
Beech	1,520	24,707					34,227
Maple							25,500
Miscellaneous	115,989	18,774		10,000			236,894
Total	7,676,966	2,627,029	770,171	3,569,817	2,424,595	1,302,617
Per cent of all ties purchased in region	74.5	25.5	17.7	82.3	65.0	35.0
Total of hewed and sawed	10,303,995		4,339,988		3,727,212		77,981,227
Per cent	13.2		5.6		4.8		100.0

The Southern States rank first, furnishing over 38 per cent, while the Central States rank next with nearly 23 per cent of the total number of ties. These groups of States, which comprise practically all of the great hardwood forests of the country and all of the cypress and southern pine forests, furnish nearly two-thirds of the number of ties. The Lake States rank next with 15 per cent, followed closely by the North Atlantic with about 13 per cent. Thus it will be seen that practically 90 per cent of the ties are now obtained east of the Rocky Mountains. The Pacific Coast and Rocky Mountain regions, as yet, are not very important factors in the production of ties. This is explained by the fact that these regions at the present time probably do not supply tie material for much trackage beyond their limits, since the long haul to the eastern market makes it impossible for their ties to compete successfully with ties produced in the East.

The method of production in the Pacific Coast region, as compared with other regions, is brought out in a striking manner. It will be seen that the Pacific Coast is the only region in

which more sawed than hewed ties are produced, 82.3 per cent being sawed. Practically the opposite condition is found in the Southern, Lake, and Central regions. The Rocky Mountain region follows next in proportion of sawed to hewed ties. Here, however, but 35 per cent are sawed. This condition is explained in part by the fact that timber is more plentiful and the stumpage value lower in the West than elsewhere; consequently the market for the lower grades of lumber is poor, and as there is always a ready market for ties, much of the lower grades is sawed into ties. Other factors also have an influence, the most important of which is the sparse population, which deprives the region of the supply obtained from farmers' woodlots, an important feature in the eastern tie market. While it is not to be expected, as with the production of lumber, that the Pacific Coast will ever become the chief source of supply for railroad ties, nevertheless the proportion will doubtless steadily increase.

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As a result of the realization that the supply of tie material was not limitless, and more especially when it was found that the durable white oak could no longer be secured in sufficient quantities to meet the demands for renewals and new track, an attempt was made to devise methods for increasing the length of service of the inferior woods. Tie plates were introduced with marked success in reducing the wear when used on soft woods. It was soon found, however, that the tie plate was not sufficient, since the wood decayed so rapidly that renewals in a short time were often necessary. To meet this problem, experiments in preservative treatments of ties were taken up by several railroad companies, some of them working in co-operation with the Forest Service, and it seems safe to predict that within a comparatively short period of time more treated than untreated ties will be used. The statistics for 1905 show that 7,510,000 ties, or nearly 10 per cent of the total number purchased, were given a preservative treatment of some character.

During 1905 at least ten railroad companies were operating their own plants for the preservation of their construction material, and several others are contemplating the installation of such plants. In addition to the roads which treat their own tim-

ber, many others have their timber treated at commercial treating plants.

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W. M. HAYS,

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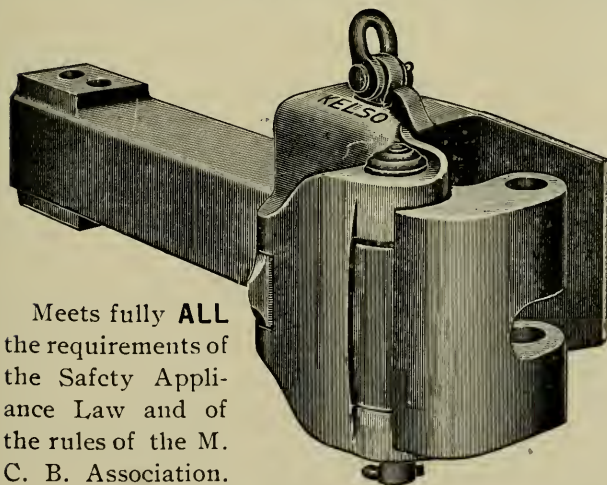
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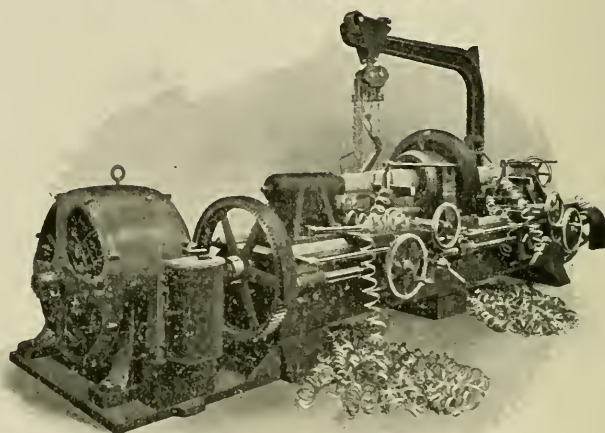
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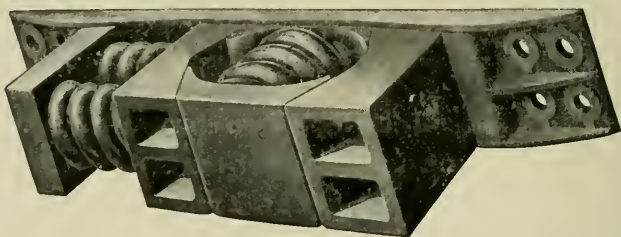
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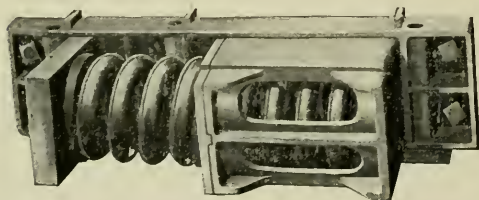
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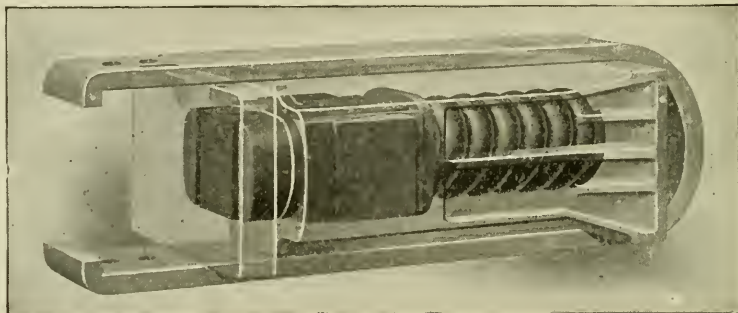
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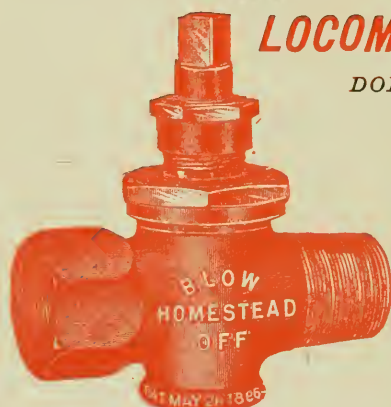
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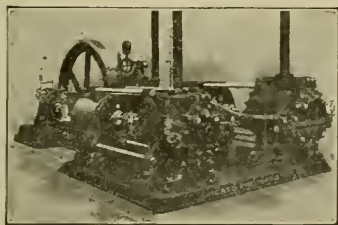
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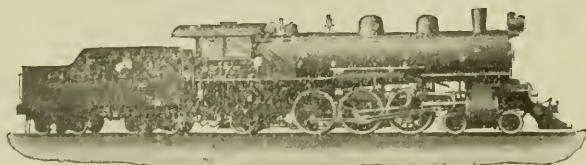
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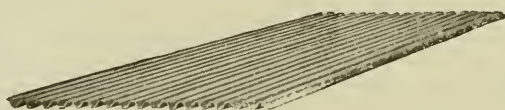
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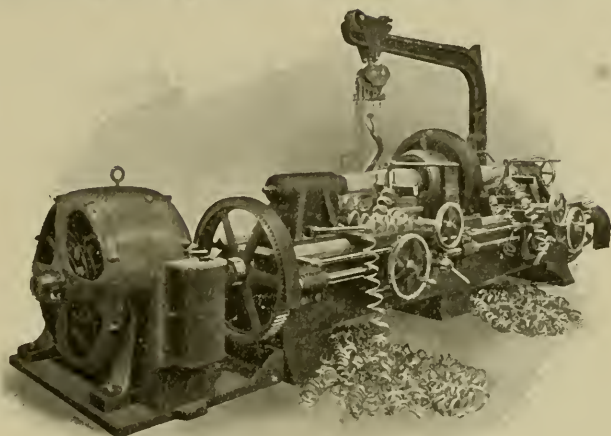
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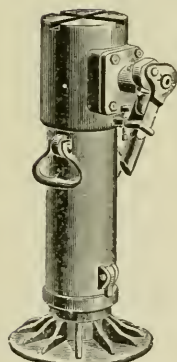
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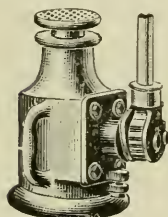
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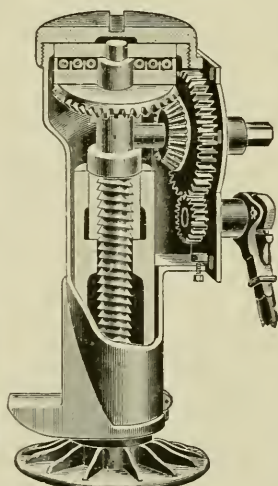
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Meetings held fourth Friday each month, except June, July and August.

**PROCEEDINGS OF MEETING,
JANUARY 25th, 1907.**

The meeting was called to order at the Monongahela House, Pittsburgh, Pa., at 8:00 o'clock P. M., with President F. H. Stark in the chair.

The following gentlemen registered:

MEMBERS.

Barney, H. E.	Maguire, W. E.
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Chittenden, A. D.	McAndrews, J.
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Conner, J. E.	Partington, James.
Conway, J. D.	Peck, C. D.
Cox, P. L.	Phelps, W. H., Jr.
Crawford, H. M.	Phillips, C. J.
Curtis, H. C.	Porter, H. V.
Davis, G. H.	Randall, E. J.
Dawson, W. J., Jr.	Redding, D. J.
Day, Edw. B.	Reese, E.
Drayer, U. S.	Reeve, F. J.
Fairman, H. T.	Richardson, W. P.
Gale, C. H.	Sattley, E. C.
Gardner, Henry.	Searles, E. J.
Gilg, Henry F.	Stark, F. H.
Grewe, H. F.	Stewart, W. W.
Grooms, J. C.	Stucki, A.
Gulick, H.	Sweeley, G. P.
Gurry, Geo.	Taggart, W. G.
Hamilton, F. M.	Tamkins, B. L.
Herrold, A. E.	Thomas, C.
Howe, D. M.	Townsend, T. E.
Johnston, C. H.	Turner, L. H.
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VISITORS.

Allen, Walter H.	Morrow, W. M.
Burnette, Geo. H.	McClay, Sam'l.
Case, M. L.	McLain, D. R.
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Lightner, W. J.	Sutter, L. P.
Lindsay, C. T.	Tredway, W. T.
Moore, Chas. L.	Wilson, J. P.
Moore, G. E.	Yon, Chas.

The minutes of the last meeting being in the hands of the printer, the reading of them was dispensed with.

The Secretary read the following proposals for membership:

- P. S. Crawford, Rep., U. S. Graphite Co., Colonial Hotel, Pittsburgh, Pa.
- A. E. Duckham, Civil Engineer, House Building, Pittsburgh, Pa.
- H. M. Hallett, Rep., Pennsylvania Crusher Co., Keystone Bldg., Pittsburgh, Pa.
- C. H. Johnston, Rep., Johnston, Morehouse & Dickey, 106 Market Ct., Pittsburgh, Pa.
- D. L. McKee, General Foreman B. & B., P. & L. E. Railroad Co., McKees Rocks, Pa.
- R. M. Pearce, Res't. Engr., P. & L. E. Railroad Company, General Office, Pittsburgh, Pa.
- L. A. Turner, Ass't. to Traf. Mgr., Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.
- Willis Whited, Civil Engineer, care Department Public Works, Pittsburgh, Pa.
- Lawrence B. Dashiell, Rep., Pennsylvania Malleable Co., 51 Sprague Ave., Bellevue, Pa.
- W. J. Riddell, General Yard Master, P. R. R. Co., 362 Princeton Place, Pittsburgh, Pa.

PRESIDENT: We are very fortunate on this occasion in having with us one who will present to you the preliminary paper

which has been sent to you, Mr. James P. Wilson, and without further introductory remarks I will ask Mr. Wilson to come forward.

MR. J. P. WILSON: Mr. Chairman and Gentlemen: I thank you for your cordial welcome. I am glad to be with you. I really do not know of any good reason why I should be here, however. As I understand, my speech has been printed and has been distributed to you. I cannot think of any good purpose that I can subserve by being here except perhaps it be this, that you may all have a full view of the guilty person.

I have been wondering how I could give to the discussion of this somewhat dry and technical subject a touch of human interest.

THE RISKS OF THE TRADE.

BY MR. JAMES P. WILSON, ATTORNEY AT LAW.

We read with dismay the blood stained chronicles of our national history, of carnage, slaughter and white up-turned faces in the wake of battle, and humanity is moved to compassion; but verily the tragedies of peace, though less dramatic, are more profound than the sacrifice of war. You need not to be told that during the four years last past, the total number of fatalities in the army of working men upon railways, in factories, mines and elsewhere in the United States, arising out of the relation of employer and employe, exceeds by many thousands the deaths on battle field and hospital in both the Union and Confederate Armies during the four years of our Civil War. Not Gettysburg, nor Chickamauga, nor the bleaching bones of the Wilderness, compared in pathos with the opening years of this century. The world was startled by the tragic loss of life upon the Maine, but every day of the year more lives are lost by accidents in the peaceful pursuits of industry in this land—and the peace of nations is not disturbed. Eleven hundred employes will be killed next week, and the next, and the next, to the end. No historian shall record the event, no pen tipped

with immortal fire shall chronicle their passing; no bugle call shall sound their requiem. The wheels of our vast material prosperity roll over them, even as the car of the Juggernaut, and the silent army vanishes unwept, unhonored, and unsung.

All this is perhaps aside from the subject of our discussion. It is inevitable. It goes without saying that in this Christian nation, generally speaking, no reasonable precaution will consciously be omitted by an employer of labor tending to make the place or the instrumentalities of labor more secure, and to minimize the risk of injury and death. The dictates of humanity, as well as the sound business policy of avoiding liability, are strongly urgent motives, moving in harmony to achieve the same result; and those details in the safeguarding of machinery, or places of work, in mill, mine or railroad, which the employer on his own behalf, and on behalf of his workmen, perchance overlooks, is zealously safeguarded and enjoined upon him by a vigilant State and Nation.

We are all witnesses to the fact, however, that no manner of legislation, no degree of minuteness of inspection, no discipline however severe, no rules or regulations imposed by the employer however drastic, looking to the increased safety of his operatives, nor all these forces combined are at all adequate to reform humanity. They prove ineffectual against temporary lack of attention, momentary forgetfulness, the taking of unnecessary risk, personal neglect, and sheer foolhardiness. Against these frailties of mankind the ingenuity and enlightenment of this age battles in vain. No folly detector has yet been devised, so delicately adjusted as to fathom the rash intent or frustrate the reckless act. The greater number of casualties resulting from the relation of employer and employe are brought about either solely by the lack of attention, carelessness, or neglect of the injured person himself, or by kindred acts of negligence upon the part of one or more of his fellow workmen, the direct and disastrous consequences of which are visited upon his neighbor, sometimes upon both.

If a farmer sends two of his hired workmen into the wood to chop timber and one of them carelessly lets slip his hold upon the ax, sinking the blade into his fellow workman's leg, it would strike the average intelligence of mankind as very unjust to

hold the farmer liable or accountable in damages to the injured man. It is not easy to distinguish such a case in principle from the case of a man engaged in driving rivets in a boiler shop, who carelessly lets slip his hold upon the handle of the hammer and strikes out his fellow workman's eye; or from the case of a switchman working for a railroad company, who in a moment of carelessness leaves the switch open and derails an on-coming engine, injuring the engineer. There is no difference in principle. There is no reason or justice in holding the common employer liable in either case. Yet many of the States of this Union have thought otherwise, and statutes have been enacted making the employer of labor upon railroads or in factories or in mines, absolutely liable to an employe injured by the personal carelessness or negligence of his own fellow workmen. This species of legislation has hitherto been considered by the legal profession, either as an echo of a too strenuous agitation on the part of the labor Unions, or as the driftwood cast up by a wave of populist sentiment, which, from time to time has swept the State.

Now, however, we are constrained by recent events to modify our opinion upon this subject and to inquire whether there may not be a broader aspect to this whole question.

In June of last year the Congress of the United States enacted a law applicable to railroads engaged in inter-state commerce, more drastic in its provisions than any legislation heretofore enacted by any of the States,—providing upon this particular subject, in effect, that the fact that an employe was injured or killed solely by the negligence of his own fellow workmen should constitute no defense to the railroad company. This was followed up by the President of the United States in his last annual message to Congress, in which we find, among other things, the following forcible expression:

“Among the excellent laws which the Congress passed at the last session was an employer's liability law. It was a marked step in advance to get the recognition of employers' liability on the statute books, but the law did not go far enough. * * * Compensation for accidents or deaths due in any line of industry to the actual conditions under which that industry is car-

ried on should be paid by that portion of the community for the benefit of which the industry is carried on—that is, by those who profit by the industry. * * * It is therefore clear to my mind that the law should place this entire ‘risk of a trade’ upon the employer.”

As we have already seen, there is no warrant for this species of legislation upon any principle of natural justice. The argument being, not that such a law is *just*, but that it is *necessary*; that the deplorable number of casualties arising in the relation of employer and employe imperatively demand, as a matter of public policy, to prevent pauperism, to save the maimed and crippled from becoming a public charge upon the State, that the burden should be placed upon him who can best sustain it, that is, upon the employer. It is the strident cry of that supreme necessity of the State, which knows no law. Before this Federal statute, so heartily approved by the President, was six months old, and within thirty days from the delivery of the President’s message, the law was declared by two Circuit Courts of the United States to be unconstitutional, and utterly null and void. This ruling was not unexpected by the legal profession. The high commendation the law had received at the hands of the President did not in any degree tend to cure its obvious and glaring illegalities, nor affect to any appreciable extent the opinion of the bench and bar upon the subject.

Opposed to all this, opposed to the very theory of it, opposed to the very expediency of it, the State of Pennsylvania has from the beginning stood like a rock. No employe injured in the State of Pennsylvania by the personal negligence of another employe, can claim any right to compensation for his injury, from their common employer; no matter what the rank of the negligent employe may be, whether superior or inferior of the injured servant, except, only, such employes as are injured by the negligence of heads of departments.

A number of other States of the Union adhere to this principle with more or less consistency. The theory which has governed legislation and actuated the courts of Pennsylvania upon this particular branch of the law of negligence is this; that it is better for the working man, to enforce such laws as will have

a tendency to *prevent* accidents and casualties and the consequent maiming and death of employes, than to afford to an injured employe compensation after he has been hurt; that an ounce of prevention is worth a pound of cure. Proceeding upon this theory, it is consistently held in Pennsylvania that when an employe knows that if he is injured by the negligent act of a fellow servant he must look alone to that fellow servant for redress; when he knows that if his own negligent act injures a fellow servant, the injured man must look alone to him for redress, thereby a powerful and effective incentive to vigilance, forethought, attention and care on his own part is ever present, constraining him to the utmost precaution for his own safety and imperatively moving him, by vigilance, to detect repeated acts of forgetfulness on the part of his fellow servants likely to injure him or others, and to promptly report them. It is the theory and the practice of the Pennsylvania law that this tends in the first instance to preserve the lives and limbs of the working men. So far indeed has the legislature and the courts of Pennsylvania carried this principle, that since 1868 there has stood upon the statute books of Pennsylvania a law which provides: "That if any man who is employed by a third person to work about the railroads, depots, cars or premises of a railroad company, shall be injured by a railroad employe, that his rights to recover against the company are only such as they would be if he were employed by the company," and of course the effect of that statute is to make the many thousands of men who are employed in mills, furnaces, yards and elsewhere about the tracks and cars of railroad companies, fellow servants of trainmen, and for their negligence injuring any of these there can be no recovery. The argument is that inasmuch as these men are subjected to precisely the same risks as railroad men, working shoulder to shoulder with them, loading cars, unloading cars, or working upon cars, that the same motive of vigilance, care and attention will have the same salutary and preventive effect, if their rights against the employer are thus limited. This statute has been viciously assailed by text writers and more than once denounced by courts of foreign jurisdiction.

I may perhaps be permitted to state an interesting case very recently decided by the Supreme Court of the United States involving this statute.

A postal clerk employed by the United States Government, while working upon a mail train running between Cleveland and Pittsburgh was injured by the derailment of his train which ran into an open switch, carelessly left open by a railroad switchman. He brought suit against the railroad company in Ohio for heavy damages, and it came within the scope of my employment to defend the case for the railroad company. As the accident happened in the State of Pennsylvania, the railroad company pleaded that the law of Pennsylvania governed his rights; that he was employed by a third person, that is, the United States Government, to work upon a car of the railroad company; that under the statute of 1868, to which I have already alluded, his rights were such only as they would have been if he had been employed by the railroad company, and that such being the case, he was a fellow servant of the switchman who left the switch open, and for the negligence of that switchman the railroad company was not liable under the law of Pennsylvania. The plaintiff in reply admitted all this, but averred that the statute of 1868 was contrary to the Constitution of the United States, in several respects; that it was an attempt of the state to regulate inter-state commerce; that it deprived the plaintiff of equal protection of the law; and that it deprived him of property without due process of the law. The case was tried through all the courts of Ohio, and through the Supreme Court of that State,—every court holding that this statute was not unconstitutional, but was valid, and denied a recovery against the company. The plaintiff then proceeded, doubtless aided in his litigation by the postal clerks' union, to the Supreme Court of the United States, where the case was argued in Washington last November. In December the case was decided, the court holding that the statute was in accordance with the Constitution of the United States, and in accordance with the amendments thereof, and was in no wise violative of any of the provisions of the Constitution, and that the plaintiff could not recover.

Turning now to the State of Ohio, we find the fellow servant law still existing, but much diluted by judicial refinement and legislative amendment. There the question of liability turns upon the rank of the negligent servant. If an employe having any authority whatever to direct another servant, inadvertently

injures him, the company is liable; or if one servant who has control over another carelessly injures a servant over whom he has no control, but which servant has no control over anybody else, the railroad company is liable. The result is, to take a familiar illustration: If a train be moving through Ohio toward the Pennsylvania line and a conductor through some act of inadvertence or carelessness, no matter what, injures one of his brakemen, the company is absolutely liable in damages to the injured employe; but if before the accident happens the train has moved, even ten feet, across the line into Pennsylvania, and the employe is injured in the same way, there is no liability whatever upon the part of the company.

All over the United States the same contrariety of judicial decisions, and the same conflict of statutory laws prevails. Almost we are forced to exclaim with Tennyson:

*"That lawless science of the law;
That codeless myriad of precedent;
That wilderness of single instances, by which a few
By wit or fortune blest,
May hope to tread a path to wealth or fame."*

We have thus far been considering those casualties resulting from negligence on the part of the employes, resulting in injury to their fellow men. Of course it goes almost without saying that if injury or sudden death overtakes a workman by reason of some negligence on the part of his employer to repair broken machinery, or cars or appliances, or to make the place of work reasonably safe for that purpose, the employer is absolutely liable, and justly so; or if the employe fails to observe the precautions and safeguards prescribed by Congress or by the state legislatures, such as the using of automatic couplers, or automatic air brakes, certain required hand holds upon its cars, guards or fenders over exposed cog wheels meshing into each other, or railings or shields about revolving wheels or cranks, or saws, in all these instances, injury or death arising from their absence creates liability. Yet, all this is subject to one very material condition. If the employe knows that a machine is defective, or broken, or out of order, or that the

safeguard has been omitted, and continues to work with it, or about it, without obtaining promise to repair the defect, and is injured by it, he is conclusively held to assume the risk of that danger and cannot recover.

Referring again to the suggestions of the President of the United States contained in his last message, we find the following recommendation: "If the entire 'trade risk' is placed upon the employer, he will promptly and properly add it to the legitimate costs of production, and assess it proportionately upon the consumers of his commodities." Here we catch the first glimpse of a great idea. He would make the employer of labor in the United States an insurer of the safety and of the lives of his employes. He would ignore the cause of the casualty and would have the employer make compensation for injury or death, whether the accident resulted solely from the negligence of the unfortunate person, or from the negligence of another workman, or from the master's negligence. This proposition is not so startling as at first blush it appears. If the President had gone farther in his recommendation, and had suggested a fixed scale of indemnity, reasonable in amount, and graduated according to the extent of the injury, or in case of death, determinable by the decedent's earning capacity, so that the employer thus made an insurer might know the exact extent of his liability, so that he might in all instances insure against it and tax the amount of premium he pays to the trade, he would then, in effect, have recommended the adoption in this country of that policy and practice, which has for many years been adopted and enforced in many of the countries of continental Europe. It would transcend the purpose and the scope of this paper to give in detail the methods established by law for compensating the injured employes across the water. Suffice it to say, in general, that in Belgium, Norway and Sweden, Switzerland, France and Germany, and of late in Great Britain, legislation is constantly tending to a universal liability of employers for injury or death to the employe, in any of the industrial arts, regardless of the manner of the accident, or whether it resulted from the negligence of the injured party, or his fellow servant, or his employer. In all of those countries, however, the amount to be paid in each specific instance, whether of injury or death,

is graduated and determined by a fixed and unalterable scale, based in general upon a certain percent of the previous earning capacity of the unfortunate employe, varying according to the extent of the disability, whether temporary or permanent; or in case of death, by the previous earning capacity of the deceased, and the amount of compensation exacted by law of the employer is so reasonable and moderate that, as a matter of general experience, the aggregate amount paid by the employers of labor, under the continental system, is absolutely less than the amount paid by the employers of labor in America, who pay upon the theory that only those who are deserving of compensation shall be paid.

In Norway and Sweden the government insures all workmen against accident or death. The premium is paid by the employer, but the expense of administering the insurance department is defrayed by the State. The amounts paid are based upon a percentage of the last yearly wages earned by the injured or deceased person. These benefits are paid so long as the disability, either partial or total, continues. The percentage varies in proportion to the severity of the injury. In case of death the widow gets 60 per cent of the last annual wages for life, and each child under fifteen gets 15 per cent until it reaches that age. The employer is not permitted to deduct the premium he pays from the employes wages, but that he has, doubtless, long since anticipated the advice of President Roosevelt, added it to the cost of his product, and taxed it to the trade.

In Switzerland, while the government has not gone into the insurance business, it compels an employer of labor to take out accident insurance for his workmen, and the premium may not be deducted from their wages.

In Germany the government requires that all those manufacturers engaged in a certain line of production shall stand the entire risk of the injuries or death to employes engaged in any of the plants where those lines of manufacture is carried on. This risk must be insured against, and the insurer graduates the premium in proportion to the relative risks in the different plants. Thus all workmen are insured. For all total permanent disability two-thirds of the last annual earnings are paid for life, and proportionately less for partial temporary or

partial permanent disability. In case of death 60 per cent of the annual wages go to the widow for life, and 20 per cent for children during minority.

In France there is a fixed scale of price to be paid, but insurance against those risks is optional with the employer. The Government enjoins,—First, the payment of all medical and funeral expenses. Second, commencing with the fifth day after the accident for temporary incapacity, one-half wages during the time of his disability. Third, for a total permanent disability, two-thirds of the annual wages for life, and proportionately less for partial, permanent or temporary disability. In case of death two-thirds of the annual wages go to the widow, and fifteen per cent for minor children during minority. Against these risks the employer in France protects himself, either by ordinary indemnifying insurance, or by mutual protective insurance associations organized among the employers, or by insurance in the Government National Accident Insurance Bank. The premiums may not be deducted from the wages, but are undoubtedly added to the price of the article, and most cases collected from American tourists, who, in turn, become smugglers with more or less success.

In Great Britain, since 1887, payment is compulsory upon railroads, factories, mines, quarries or engineering works. In case of death, not more than the last three years' annual earnings shall be paid to the widow or dependent family, and in no event shall an amount be paid exceeding three hundred pounds, and proportionately less if the family be not dependent. In case of permanent or partial disability, from 50 per cent of the annual earnings down, but in no case to exceed one pound per week.

For obvious and sound reasons the application of such a system to the industrial conditions of the United States would be attended by extreme difficulty, if indeed its adoption were at all possible or desirable.

In the first place the Federal Government is absolutely without authority to enact or enforce laws of that character. As we have seen, the employer's liability act of the last Congress, even though limited in its operation to railroad companies engaged in interstate commerce, met with disaster in the first

United States Court, which tested the authority of Congress to enact it.

The individual States alone may legislate upon the subject within their own territorial limits. We have already noted the vast difference, the utter contrariety of existing laws upon this subject in the various States of this Union; the divers theories and principles which obtain in different localities. What reasonable ground for expectation have we that all the States would ever agree to fasten a general liability upon all employers of labor. A system which to some of them may appear beneficent, to others is most repugnant. If by a wild flight of fancy we can imagine that all the states would agree to such a law, who so rash as to venture to suggest the adoption by all of a uniform, limited, reasonable and moderate scale of payments and indemnities in case of injury or death, such as would subserve the purpose of an enlightened public policy without destroying utterly the very fabric of our industrial prosperity! Such a system, in short, as the nations of Europe which really govern, administer with humane results, for their people. What state legislature so deaf to the unthinking clamor of the multitude, so blind to its own political fortune, as to stand against extortionate demands for high and ruinous rates of compensation?

Fortunate, indeed, are we that those conditions under which the policy of universal compensation, so advantageous in continental nations, the breeding place of pauperism and low wages, find no prototype as yet in the flourishing industrial prosperity of America.

If ever those conditions arise in our own country, we shall hope, not without grave misgivings, for that surcease of folly which in moments of critical import in this republic, has on rare occasions led us to sacrifice popularity upon the altar of wisdom. Until those conditions arise when the supreme necessities of the state transcend the law, we may safely follow where even-handed justice leads the way,—Though she travel with a leaden heel, she strikes with an iron hand.

PRESIDENT: Gentlemen—It is seldom we have been favored with so forceful a discussion on a subject of such import to not only the employer but the employee. If the man-

agers of our local railroads or manufacturing plants had known that this paper would be presented in this manner I am sure many applications would have been presented for admission here tonight.

I trust the members and guests here will feel free to discuss the subject and ask questions.

Without having given any one any particular notice, I will take the liberty of calling on Mr. H. W. Watts to open the discussion.

MR. H. W. WATTS: Mr. Chairman—I feel sure that I voice the sentiment of everyone present when I say that it was entirely unnecessary for Mr. Wilson to make any apology for making the subject elementary. Mr. Wilson has shown that he possesses the faculty which all lawyers do not possess, of presenting a case to the jury in such a way that the jury understand and know that he realizes the difficulty that exists in the lay mind when it is brought face to face with the ramifications and interpretations and mystifications connected with statements of law. And those of us who have ever, either in our own behalf or that of our employers, been brought face to face with legal questions realize how easy it is for the lay mind to become entangled in the meshes of the law and its interpretations. And I am glad Mr. Wilson has made the subject so clear tonight.

Speaking of the law of Ohio, Mr. Wilson has called attention to the fact that an employee having any authority whatever over a fellow-servant, should he injure that servant, the company becomes liable. I want to call your attention to one point where the law of Pennsylvania is directly the converse of that, as illustrated by an incident which came under my observation, that is, where a foreman or head of a department, instead of directing a certain thing to be done by another employee attempts to do it himself, and by reason of his action an employee is injured, the company is not liable, because the foreman has ceased for the moment to be the agent of the company and becomes a co-employee. Some years ago a couple of railroad laborers were pushing a car along the edge of a steep bank. They had barrels of water and their business was at intervals to dump the water over on the hot cinder bank to cool it off and ex-

tinguish the fire. They stopped and had the barrel just tipped on edge and the foreman became impatient and took hold of the truck himself and gave it a push, with the result that one of the men lost his balance and fell over the bank and received an injury which necessitated the amputation of his leg. He brought suit against the company and employed a reputable lawyer, fortunately for himself. The attorney for the company discovered that a suit before the Supreme Court had recently been decided on the line I have just indicated, that a foreman of a department who attempts to work with the men instead of directing another to do the work becomes a co-employee, and the company is not liable if his co-employee is injured. The attorney for the company called the attention of the attorney for the plaintiff to this fact, and he at once advised his client to drop the suit, which he did. And I may remark incidentally that the railroad company cared for the injured employee and he is still in the employ of that company and likely to be as long as he lives. I thought this might be of interest to us because, while it is well known to the members of the legal fraternity, among the laymen it is not so generally known.

PRESIDENT: I believe Mr. George E. Shaw is present, and we would be glad to hear from him.

MR. GEO. E. SHAW: I came here rather to listen than to attempt to give any expression of any view I may hold. I may say that I am therefore not prepared to go into a discussion of this question. At the same time, I have been very much interested in the paper which Mr. Wilson has read, and very much impressed within the last week with the seriousness and importance of this subject. At this session of the Legislature in this State there have been introduced no less than five Employer's Liability Acts. It is a very live question. It is a matter that concerns this whole community, and one in which the community is very much in earnest. I was handed today a draft of a bill introduced by a member of the Legislature, whose name I have forgotten, repealing the first section of the Act of April 14th, 1868, mentioned by Mr. Wilson, the Act under which Mr. Wilson took an appeal to the Supreme Court of the United States and in which he covered himself with glory, sustaining the constitutionality of that act. Several of the provi-

sions of that Act bear so heavily on employees of railroad companies that concerted efforts are now being made to repeal it. Whether it is wise or not that this Act should be repealed is a question that I think is fairly open for discussion. Whether it be right that a postal clerk employed by the Government engaged in assorting mail on a railroad car traveling between Pittsburg and Cleveland, for whose transportation the Government of the United States has provided in its contract with the railroad company, should be regarded as a fellow-servant of the servants of the railroad company who are concerned in the operation of that train, I think is a fair matter for discussion. I express no opinion about it.

I was very much impressed with what Mr. Wilson said with reference to the laws of Norway and Sweden, which provide for indemnity to employees who suffer injury. We have been informed to the effect that 1100 men, today in the vigor of health, will on Friday evening of next week be laid in their graves. The community owes a duty, the community is bound to take cognizance of such a condition of affairs. Some provision that will protect the community from the pauperism which follows from such results must be enacted. Our present laws are haphazard. Some employee, by reason of a state of facts which he is able to establish, secures adequate compensation for an injury which he sustains in the course of his employment; another fails, and he with wife and children may become charges upon the community. This is not reasonable. But we should direct our efforts toward devising something which will provide for the protection of the community against such results. As Mr. Wilson states, in the case of the farmer who employs two men who chop down a tree and one is injured by the carelessness of the other, it would be monstrous to say that the farmer, who has perhaps \$10,000 or \$5,000 invested in his farm, should be required to respond in damages to such an injury. Industrial conditions imperatively demand some provision against this.

I believe that no wiser course could be pursued than that you gentlemen have here of discussing such questions. I believe this Club is engaged in a work which will enure to the benefit of the community, and I sincerely hope its efforts will be continued and will ultimately result in something tangible,

something that can be of use to this great community, which is so vitally interested in such questions.

PRESIDENT: Dr. Milligan, will you tell us how well the railroad companies take care of their injured?

DR. J. D. MILLIGAN: I do not meet these people until after they are injured, and sometimes I am blamed because I say to them, "How did you get hurt?" As a rule they tell me the truth; for a man in pain and suffering is more likely to tell the truth than he is after somebody later on comes to realize that he has a better chance to make money out of his attorney friends than he has out of the poor doctor.

It is terrible to think that 1100 of our fellow-beings will be rafted out of existence next week. But out of this 1100 every week my personal experience has been that 1099 were injured because they were careless, and it was their own fault, or some one else was equally careless, when the facts have been all sifted out.

An employee will come to me and say, "I was hurt so and so. Of course, it ought to have been fixed, and I got in there to fix it and was hurt." Why did he get in there? Does the law compel a man to endanger himself to that extent? If men to begin with were more careful the percentage of accident to destruction of life would be very much less. You cannot control an automobile, a railroad or a mill. When you take into consideration the immense volume of material that is handled, there are accidents that are unavoidable. Some chain may break; there may be some trouble with a furnace that might explode; boilers may explode on railroads or in shops. These things do occur. But when they are carefully sifted down there is generally a reason why, and you do not have to have a provision written up here.

There were several Irish friends walking up the street not long ago who saw a Hebrew sign on a meat shop. One of them looked at it and said:

"Pat, can you read it?"

"No," said Pat, "but if I had a fiddle I believe I could play it, and without the fiddle I can smell it." He scented danger.

There is a difference in men's perception of danger in this world, enough to make a man think that he should take ad-

vantage of that sense and be particularly careful to govern himself accordingly. There is no use in talking about the sad moments spent by the bed side as they stoop over their dear friends who have been injured by accident. There is nothing on earth that moves but that will kill. The electric car and all these other means which we consider necessary to life will injure man and destroy life. Did you ever stop to think that when they went by wagon across from Philadelphia to Pittsburgh there were not nearly so many people hurt? or nearly so many people hurt by railroads when they thought they could not get to Cleveland the same day unless they started in the morning? Three hours and a quarter is not a long time in which to go to Cleveland now.

When you come to the increased impetus of the rapidly moving trains, you cannot help but increase the liability. We are traveling too fast as a nation in some directions. We are not *multiplying so awfully rapidly*, but 1100 beings killed can be accounted for by our industrial and mechanical world, our railways and railroads, our automobiles and like means of conveyance, which do not hesitate to run 30 and 40 and even 60 miles an hour. We are moving too fast, and we do not begin at the right end of the song. We look on after it is all over. The employees of every industry today should be *more intelligently educated* in their business, the same as our worthy friend from Youngstown here, Brother Wilson.

I have always thought I would like to call an attorney brother, for their thoroughness is akin to that of the surgeon in the risks to the trade, and he has made such a beautiful address here and has given us such a treat, and, like a true attorney, has covered up every little opening so neatly that you can't get him to convict himself—and I find I am doing that and will sit down.

PRESIDENT: Mr. Gurry, we would like to hear from you.

MR. GEORGE GURRY: Mr. Chairman—I do not know that I have anything that I can say, except that I thoroughly enjoyed the paper Mr. Wilson has given us. Personally it is a matter of very great interest. I feel that the industrial concerns are not without heart, and that their desire of wanting

to know where they stand and what the law is, is not with the idea of getting out of the thing or shirking responsibility, so much as to know when they are imposed upon. The greatest amount of my experience in this line was in Rhode Island, and in that State there is not this universal law as has been described in Pennsylvania, consequently it is hard to tell where an accident is going to end. And it depends altogether on how smart a damage lawyer is whether they get \$5,000 or \$25,000 or anything else. As one of the speakers has said here tonight, the whole subject is one that is open for discussion. It would seem almost sometimes that under this law of 1868, as it has been described here tonight, somebody is to suffer unduly. And yet, on the other hand, it certainly ought to make everybody careful to know that for each accident he himself is personally liable.

MR. HENRY F. GILG: It has been my duty to attend to a good many accident cases, and in every case the accident was the result of carelessness or neglect on the part of the employee or of a fellow-employee, invariably the injured applying to the company for redress, never to the employee who may have caused the injury. As Mr. Wilson suggests, the employer can add the cost that arises from an accident to the amount the purchaser is compelled to pay for his goods, but this makes the innocent party foot the bill. It would seem to me, that in case of any accident, outside of what may be caused by defective machinery, etc., that an employee or a co-employee who is the cause of the accident should be made a party defendant in the suit. While he may not be able to pay monetary damages, he should be compelled to pay by imprisonment or in some other way, if the employer has to pay a monetary damage. It would not be fair to let the innocent parties, like ourselves, pay for accidents in establishments where we are purchasing goods, with which we have no direct connection. If the employee who caused the accident is allowed to escape scott free it will promote carelessness and negligence on the part of the employee.

Mr. J. P. WILSON: Of course, such a proposition as that advanced by the President of the United States cannot be justified on any ground of fairness at all, and he does not put it on that ground. He simply puts it on the ground of necessity,

which knows no law. That is, that it is better for the community that everybody should be paid regardless of how he is hurt than that those—by far the greater number—who are hurt through their own fault or the fault of their fellow-workmen, should be made a charge upon society. Of course, if a workman injures another, he is liable and may be sued. But as in 99 cases out of 100 the negligent employee is irresponsible financially, if we adopt a system which would compel him out of his future wages to in part indemnify his employer for what his negligence has cost him, we can readily foresee the result. He would at once abandon that employment and seek employment elsewhere.

Of course, we can all readily understand the difficulty of adopting any law of universal compensation. It can only be supported on the ground of supreme public necessity. That is the argument which has been made elsewhere, and the argument which I think it does not take a very long look ahead to see will ultimately prevail here.

The railroad companies meet this in many ways. A number of the large trunk lines have benefit associations, insurance associations, providing for indemnity, and no matter how the employee is hurt he receives the indemnity; but the acceptance of the benefits cuts off all recovery against the railroad company. The majority of the industrial plants insure their risk, so that they do not know just how much to add to the cost of the commodity. I suppose the great majority of industrial plants in America today carry liability indemnity. They pay so much per man in their employ, and when a man is hurt, if the liability of the company is finally established, the indemnity company pays the loss. The employer pays the premium and knows exactly what it costs him to carry that risk and he can add it to the trade. It is only a step farther to place the liability entirely upon the employer. But, as I have intimated, the great difficulty is to procure throughout the different States a uniform rate of liability compensation. The Federal Government cannot say to an employer, "You shall pay your employee who is injured a certain rate of compensation." The Federal Government is utterly without power; only the individual States may do it, and there will be as many rates of compensation as there are States, depending on the sentiment of the community.

PRESIDENT: We would like to have persons propound questions to Mr. Wilson. We would like to have remarks of two or three minutes' duration. Mr. Tredway, can we hear from you?

MR. W. T. TREDWAY: Mr. Chairman—I am only a visitor here tonight and did not know even what subject was to be discussed. However, I was delighted with the beautiful address delivered by my compatriot from Ohio. I was a native of Ohio, and think perhaps Mr. Wilson has gone up against E. W. James of Coshocton, O., an old uncle of mine out there, in a number of railroad cases. I assure you the discussion here tonight has been very instructive to me as a lawyer. The subject of law is so very broad and is so much specialized in these days that it is only the railroad lawyer who can discuss this matter properly, unless it be one who has been recently educated in a case looking toward the liability of employer to employee.

There is one thought that struck me very forcibly in our friend Wilson's discussion, and that is this: Taking the illustration of the farmer, I was raised on a farm and know something about cutting down trees: If the farmer is negligent in employing a man whom he knows to be particularly negligent, and he puts up against him a man who is skillful, and the negligent man by accident cuts the other, then I think Mr. Wilson will agree with me that the farmer is liable. The same is true of a railroad company. If they, by employing a man whose reputation they know is bad, and who is unskillful for the work for which he is employed, if they choose to put this man in the service and he negligently injures a co-employee, I think that is an exception, if I have read the law correctly.

Another thought that occurred to me: Why is it that I, as a passenger, have any greater right to hold a railroad company liable to me if injured upon a train than has a co-employee? I listened and followed with great interest the line of argument by which the passenger is safeguarded by the reason of the very fact that an employee injured by the negligence of another cannot recover against the corporation, and thereby they are that much more careful, and that carefulness enures to the benefit of the passenger. But why is it, when a man is entirely innocent, engaged in his daily vocation, and suffers by reason of the abso-

lute negligence of another, that by reason of the fact that he happens to be an employee of the company simply his rights are lost so far as damages are concerned and his family should have to bear the brunt of it, any more than the passenger? I cannot see the distinction except as a matter of policy. I think that the Oriental criticisms of the Act of 1868 are entirely justified. But when you come to think it out, railroads are placed in a very peculiar position. We have, as Mr. Shaw says, before the Pennsylvania Legislature today no less than five different Employer's Liability Acts, or bills introduced to be enacted into law. Of course, they will be sifted down and they will all disappear except one, and perhaps they will all be defeated in committee. However that is, you say the railroad shall be liable to this man for so much money, if they can so draft their Act as to comply with the Constitution, and not be set aside by the first judge before whom it comes. Then they say, we are going to have a two-cent fare. If they can limit it to two cents, why not a cent and three-quarters or one cent? And if you are going to do that, where is the money to come from to pay the damages that go to the employees and the widows and orphans that are left behind? So you see, it is a great problem, and it is all beyond the power of human ingenuity to devise and work out; and especially in this great industrial State of Pennsylvania, where we pay out in Allegheny County alone to employees a million dollars every day in wages—it is almost impossible for human ingenuity to work out these equities.

But after all that is said and done, we can not get away from the fact that there are some good lawyers who do not go around after a case the moment they see an account of an accident in the paper. There are some who do not train them how to testify so as just to be able to carry the case to the jury. I remember when I was a very young man the impression I had of the railroads. I thought they were to ride down everybody, and go through a man's property, and use up their lands and give them nothing in return. My experience with railroad travel has greatly broadened that idea, and especially on account of the courtesy of the particular railroad on which I have traveled for the last twenty years nearly every day. We ought not to boast, because we never know when our turn is coming; but I

believe it is said that the P. & L. E. Railroad, on which I ride twice a day, has never killed a passenger. There is some reason for that. Have they been more careful, have they exercised greater care in the selection of their employees, or do they have rules which better safeguard? Of course, their employees are injured and killed, but some way Providence has saved their passengers. I read an article in the Literary Digest the other day about this block system. Now I do not even understand what a block system is, but I have the impression that where the block system is used in its perfection you never can get two trains between two blocks at the same time. I read how the Northern Pacific had been experimenting on how to get out of dilemmas. In other words, they purposely ran an engine in just to scare an engineer and see what he would do under the circumstances. And I noticed by that article—and I would recommend railroad men to read it as a very interesting discussion along that line—that with all those experimental trials they have never once had a wreck by reason of the failure of the system to work. I was in North Carolina the other day and coming up I heard this story, and it vividly portrayed a bit of my own experience. They run anywhere from six to twenty-four hours behind down there. A fellow was going down in a cab to get the train and he was urging the driver to hurry. Somebody said to him: "You do not need to hurry, that train will be late. It is always late." Well, he got almost down to the depot when in pulled the train. He grabbed his traveling bags and sailed out into the depot and succeeded in catching the train, saying to the conductor that it was strange they had to come in on time today. He said: "Is that what put you out of breath? Well, you have got another guess coming. This is yesterday's train."

MR. L. H. TURNER: I would like to ask Mr. Wilson a question. We know that Mr. Wilson occupies an eminent position in the legal world and has spent years defending personal injury cases. Dr. Milligan also occupies a very eminent position in the medical world. It has been my privilege to attend to the procuring of evidence for Mr. Wilson's use in many cases, and I have spent months of my time sitting in a court house and listening to evidence largely of the medical expert nature. And we have had occasions where a physician for the prosecution testified that the man would hardly live to get out of the court

room, and then we would hear the defense say that the man never was seriously injured in the first place and should not have left his work. I would like to know what gets in the doctor's eyes that makes him think the injury is so slight in one case and so serious in the other?

MR. J. P. WILSON: I am not a mind reader; I cannot answer that question. I know what Mr. Turner refers to; the fact that you can get almost any sort of medical testimony you want—and I say that without any disparagement to those eminent members of the medical profession of whom Dr. Milligan is one. There seems to be no limit at all to the sort of medical testimony that is expert. A man who has been injured gets into court complaining of a pain in his back, and you have four or five local physicians well known in the community, some of them family physicians to members of the jury, who for \$25 a day will testify, that putting the finger on the man's spine at the neck and running it down toward the dorsal vertebrae that he will wince every time you touch him and that is conclusive evidence that that man is suffering from some incurable spinal complaint. Of course, what is an ordinary jury of farmers and mechanics to do? Put an eminent physician like Dr. Milligan on the stand and he will say: "Gentlemen, if I do that, if I run my thumb down this man's back he will wince, I have no doubt. Whether he has to do it or whether he has been coached to do it nobody knows. The only way we can tell whether that man has spinal trouble is to see what other troubles he has also which are the invariable accompaniment of spinal trouble. When I look for that I do not find any, therefore I know the man is shamming."

I must tell you of an incident that happened in court not long ago. Dr. Milligan was out there to testify. Pursuant to his duty as medical examiner of the railroad company he had taken the statement of an injured person. He asked him how the accident happened, and he told him how it happened, "that he was not thinking, that he approached the railroad track and stepped immediately in front of a backing engine and was thrown down and his leg cut off." The plaintiff had alleged in his petition that he was trying to cross the track and he caught his foot in between a switch rod and the tie, and he was fast-

ened there for about two minutes, and then the engine came along and for the space of a thousand feet the track was clear and the engineer ought to have seen him if he had simply looked ahead, but he didn't, and that he deliberately ran up on the man and he had to throw himself across the rail and the engine cut his foot off. Well, we had the doctor's statement as to the admission made by the injured person immediately after the accident. The attorney for the other side, a very able cross-examiner, went after Dr. Milligan. He said: "What did you take the statement for?" The doctor told him his duty as medical examiner of the company required him to find out how the accident happened. "Trying to make evidence for your company, were you?" The doctor said that he was not trying to make evidence, but to get the facts regardless of whom it helped or whom it hurt. "Playing detective for this railroad company, were you not?" The doctor replied very courteously that he was a physician and not a detective. Then the Court said: "Now so long as this physician conducts himself as a gentleman on the witness stand he will have the protection of this Court, and we will not allow any brow-beating tactics to be employed, and he has thus far conducted himself with perfect gentility and he is entitled to the belief of the jury." A compliment to the doctor, I thought.

MR. GEO. T. BARNSLEY: In this discussion we have had, to some extent, two sides. On one side it has been suggested there is carelessness, shamming, maliciousness, dishonesty, to enable men to get damages from an employer. On the other side there is the humanitarian view that you must necessarily consider. This resolves itself into one fact: Somebody has to pay the freight. Damage has been done. We have the case of a poor man with a family that has to be taken care of by somebody, in some way. We don't know whether the victim was careless or not. He may have been vicious. He may have purposely suffered a foot to be cut off in order to get large damages which would save him from having to work in the future. We don't know the intent, but we have the fact: There is a charge on somebody. Therefore, I think it is for us to endeavor by our discussion to conceive of some way by which this can be taken care of in equity to all concerned. It is growing

late. What few words I can say would be of very little help. If it were possible, I would like to see the discussion of this matter carried over to another meeting. There is a great deal to be brought out. A great deal of thought is necessary, because lawyers, doctors and railroad men will certainly agree that it is a very complex problem to handle. There are many conditions which we have to face. The question is the best way to meet them and to say who shall pay the damages in justice to all. In the case of the manufacturer or mill man or railroad company, if they have to pay out money they generally know what it amounts to, because it averages year by year. That expense has to be provided for. They are in business to make money, to pay a dividend upon the capital invested. It is the duty of every man in the various positions which he may occupy to see that the property entrusted to his care is properly handled so that the investor will get a reasonable return. Now if he knows that a certain sum must be devoted to paying indemnity of course he must make his arrangements accordingly. So you see somebody must pay it, and the thing for us to discuss is, how and in what way shall it be handled? I think the whole thing resolves itself into that.

I want to say, incidentally, as a railroad man, that I have seen quite a number of accidents occur. I have seen men meet death in various ways. I have seen them meet death purely through carelessness of their own. I have seen cases where this happened through the carelessness of a co-employee. Now just a word regarding a thought that was brought out as to the co-employee. It has been suggested that if we cannot do anything else with him we can punish him by sending him to jail or to the penitentiary; that he must pay some penalty. There are cases where I think it would be perfectly proper; there are others where I do not think it would be proper. It is presumed that if a passenger is injured he will receive damages to some extent. Take the case involving employees alone. If two sets of trainmen were sent out, and through the mistake of the despatcher or operator handling the train orders the locomotives were brought together in collision and some of the trainmen were killed. In one sense they are co-employees with the despatcher or operator who made the mistake. Now, life is just

as sweet to the families of those men who are killed as in the case of a passenger, and to say that the families of those men should not receive an indemnity is pretty hard, because the operator getting perhaps \$50 or \$75 a month made a mistake. He hasn't any money to contribute. There is no money for the law to take from him. You can send him to jail. But are you going to let the families of those men suffer because a co-employee made a mistake? I say no. This is a side which a great many people think a good deal about. Some way should be devised to get this thing on an equitable basis so that where it is fair and right compensation shall be paid.

These are the two sides to be considered, and I would be very glad to see the matter carried on with that thought in view.

MR. SION B. SMITH: The County Road Engineer's Office has surely absorbed contamination from the Court House, for Mr. Barnsley has unconsciously given expression to the stock argument of all personal injury lawyers to the jury, and he has put it in most effective shape. Every one will freely concede that a man who has been injured, or the dependent family of one who has been killed through the negligence of a co-employee, ought to be indemnified. The premises of the argument are sound. But the conclusion of the argument, viz.: that the railroad or other employer should pay the indemnity, is a non sequitur. It is at the root of all law and justice that the one who should suffer is the one who is at fault, and that one is the negligent employee and not the employer. Probably no one present, except attorneys, knows that the owner of property abutting a defective sidewalk which causes injury to a pedestrian is the person *primarily* liable for the injury, and the liability of the municipality is only secondary. Yet who ever heard of a suit for damages of that kind ever being brought against the abutting property owner? There are only three or four cases of the kind in the books. The suit is always brought against the municipality. The reason, of course, is plain. We have sympathy for a fellow-being of flesh and blood; but for a corporation, which has no body to beat or soul to damn, which for most of us exists only in imagination and is said to act by a seal, there is very little which is personal enough to demand either sympathy or consideration. Consequently a

jury, which would not bring in much if any of a verdict against the poor devil who was the real cause of the accident, will with clean hands and a pure heart "soak" an invisible, intangible, bloodless, legal fiction for the benefit and indemnification of one who confessedly deserves indemnity from some source.

But in the last analysis it is the public that pays the freight. Put the burden of indemnifying the injured where you will, it is the one who consumes the product of that industry who really pays it, whether in the form of higher cost of the commodity or of higher poor taxes to support the public charges. But as it is easily conceivable that some would have to pay poor taxes to support the dependent families of injured workmen who would not use the commodity produced by the industry which injured the breadwinner of that dependent family, the just and equitable disposition of this burden of indemnity would seem to be that which would make it a charge to the cost of production of the commodity.

And it is surprising, when you come to think of it, with how small a change from present conditions that could be accomplished. Practically all industries today carry indemnity insurance, the cost of which is usually based on the pay roll. If the industries now are doing that voluntarily, through an agency which is making a profit out of it—for the insurance companies are by no means institutions of pure philanthropy—could they not do the same thing themselves, even though under the compulsion of law, and save the profit? What practical difference is there in the result between doing a thing voluntarily, and doing the same thing at the behest of law? So that it seems to me that if we want to subserve the ends of justice and equity to the injured, the protection of society from possible charges upon it, and do this with the least derangement of existing conditions, a compulsory indemnity law, similar to those now in force in Europe, is the best solution. And the change effected by its adoption would be rather a change of form than of substance.

PRESIDENT: This has been a very interesting discussion and it might be continued very profitably. But the program for the year has all been made up, and without calling an extra meeting we could hardly continue this subject. As a railroad

man I have always been a little bit prejudiced. I never could understand why a railroad company was held accountable for an injury which if it had happened in a commercial saw mill there would have been no thought of a suit. And it appears to me that a State law that would affect a railroad ought to affect any other responsible party or company.

I will not ask our friend Mr. Wilson to discuss the matter at length, but any of the points that have been raised that he cares to respond to, we would be glad to hear from him.

MR. J. P. WILSON: In reply to the query as to why railroads should be responsible in cases where saw mills and factories are not, I would suggest what my friend on my right suggested, probably because they have the "dough."

ON MOTION of Mr. Watts, duly seconded and carried by unanimous vote, the thanks of the Club were extended to Mr. Wilson for his excellent and instructive paper.

ON MOTION Adjourned.

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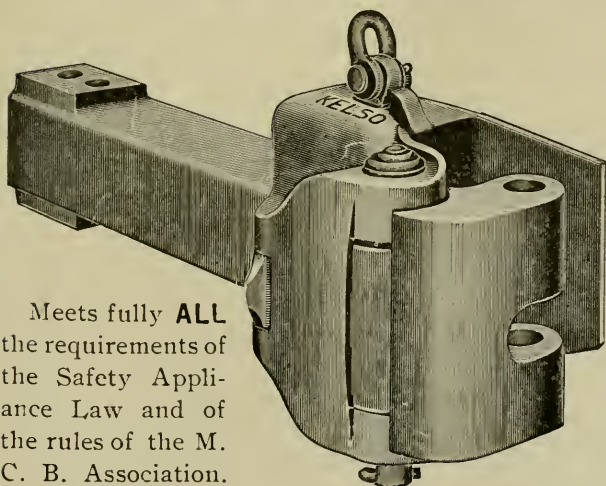
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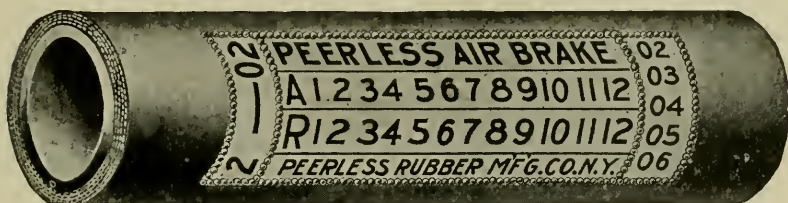
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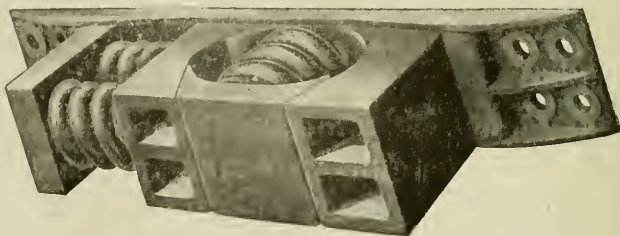
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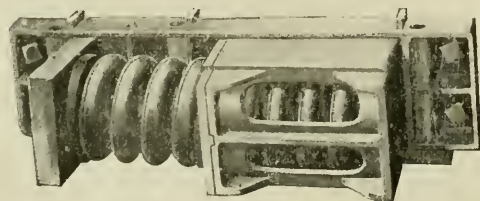
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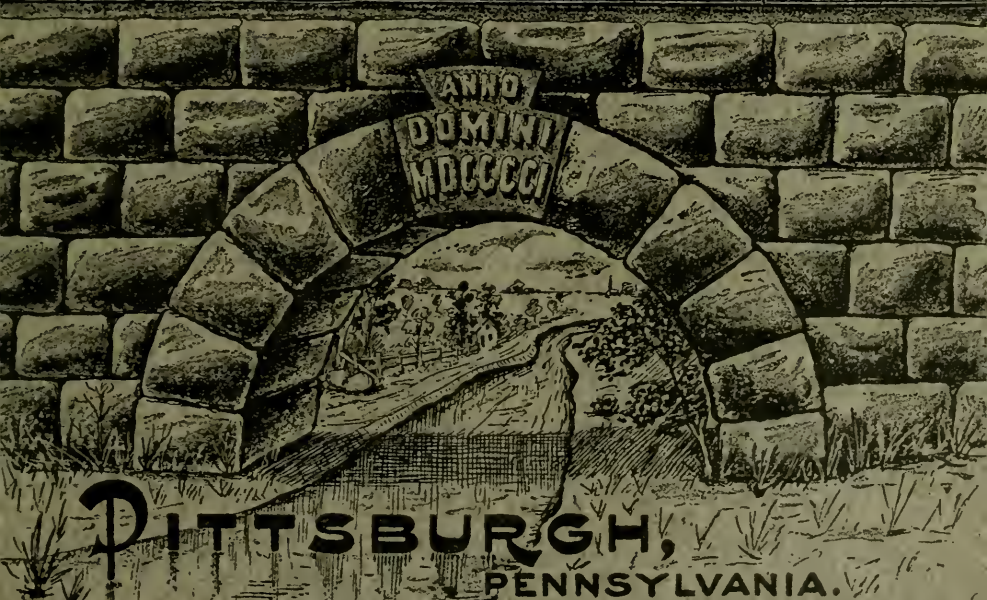
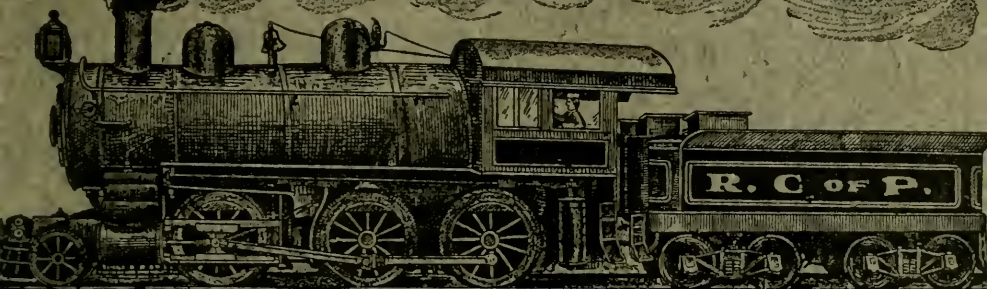
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


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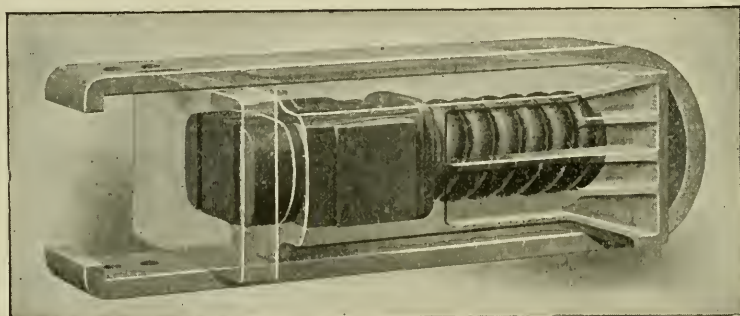
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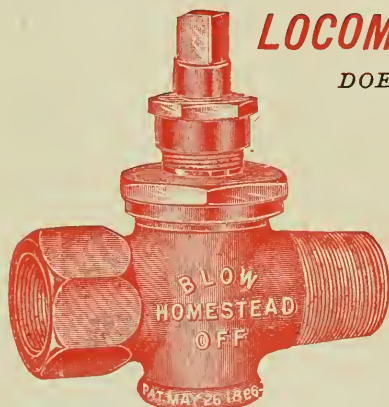
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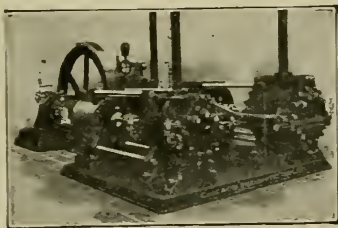
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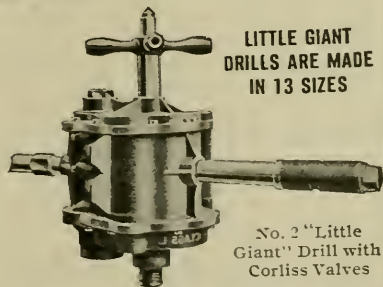
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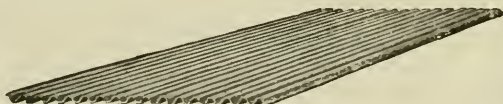
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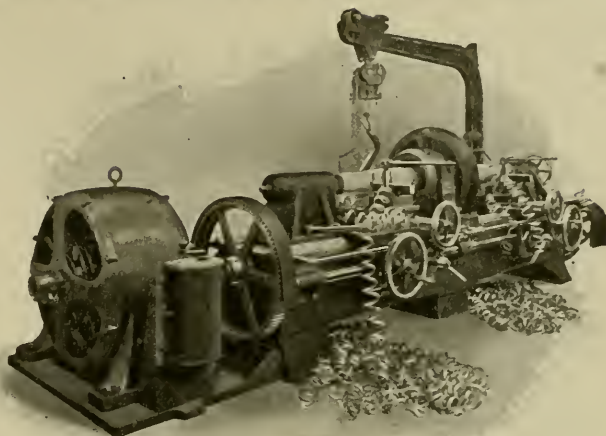
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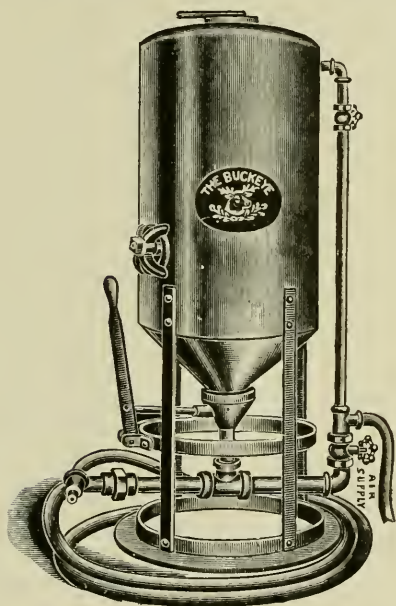


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Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING,
FEBRUARY 22nd, 1907.

The meeting was called to order at the Monongahela House, Pittsburgh, Pa., at 8 o'clock P. M., with Vice President Mr. Geo. T. Barnsley in the chair.

The following gentlemen registered:

MEMBERS.

Ault, C. B.	Knight, E. A.
Barnsley, Geo. T.	Krause, Julius.
Bealor, B. G.	Lace, Thomas C.
Bigham, C. G.	Lawson, S. S.
Bollinger, C.	Lindstrom, Charles A.
Burrell, J. E.	Lobez, Pierre L.
Collier, P. M.	Lynch, A. C.
Conway, J. D.	Millar, C. W.
Coulter, A. F.	Milligan, John D.
Cox, P. L.	Mitchell, A. G.
Dawson, W. J., Jr.	McAdoo, Jno. H.
Dorr, C. O.	McDonnell, F. V.
Drayer, U. S.	McIlwain, J. D.
Elder, Thos. W., Jr.	McKee, F. E.
Foley, F. J.	McNulty, F. M.
Gardner, H.	Peck, C. D.
Gies, Geo. E.	Porter, H. V.
Gilg, Henry F.	Pratt, Howard A.
Greer, W. J.	Proven, John.
Gnlick, H.	Randall, E. J.
Gurry, Geo.	Reeve, F. J.
Hall, C. W.	Rider, James B.
Haring, Ellsworth.	Ryan, Wm. F.
Herrold, A. E.	Schomberg, W. T.
Howe, D. M.	Stafford, B. E. D.
Jennings, F. R.	Suckfield, G. A.
Kennedy, Jas.	Sweeley, G. P.
Kerr, Jno. K.	Thomas, Richard L.
Kinter, D. H.	Travis, O. H.

VISITORS.

Barney, A. E.	Gies, Arthur A. W.
Ditchfield, F.	Gilg, E. Herbert.
Ellis, J. A.	Gilg, Harry F., Jr.
Evans, R. W.	Halleran, John L.
Fisher, A. G.	Hampton, W. M.
Gale, G. W.	Howard, W. W.

Hubbs, Geo. E.	Rogers, A. A.
Hudson, L. T.	Sheppard, F. A.
Knox, E. E.	Smith, E. W.
Krause, Harry A.	Smith, Sion B.
MacVaugh, H. W.	Van Blarcom, Howell.
Mason, E. F.	Watkins, Geo. H.
Maxwell, Lee H.	Watkins, Septimus.
McConnell, Wm. J.	Williams, Alan G.
Patterson, A. W., Jr.	Williams, Irving.
Phillips, Leo A.	Wray, R. W.

The minutes of the last meeting being in the hands of the printer, the reading of them was dispensed with.

The Secretary read the following list of applicants for membership:

- W. S. Campbell, Com'l. Agt., Chicago & Alton R. R., Bessemer Bldg., Pittsburgh, Pa.
- W. B. Everest, Traf. Mgr., Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
- A. D. Huff, Com'l. Agt., Grand Trunk Railway System, Park Bldg., Pittsburgh, Pa.
- Robt. Hunter, Com'l. Agt., M. & M. T. Co., Bessemer Bldg., Pittsburgh, Pa.
- E. E. Knox, Pgh. Mgr., Bury Compressor Co., Bessemer Bldg., Pittsburgh, Pa.
- Chas. L. Moore, Asst. Engr., P. R. R. Co., Brownsville, Pa.
- Leo. A. Phillips, Engr., Westinghouse Machine Co., Westinghouse Bldg., Pittsburgh, Pa.
- J. H. Schroeder, Pres., Schroeder Head Light Co., Evansville, Indiana.
- R. J. Smith, Frt. Agt., B. & O. R. R., 33rd and Liberty Sts., Pittsburgh, Pa.
- J. E. Weller, Dist. Frt. Solicitor, Penna. System, Bessemer Bldg., Pittsburgh, Pa.

SECRETARY: I regret to announce the death of one of our members, Mr. Augustus Dowdell, a representative of the Valentine Company of New York. His death occurred on the 10th day of the present month. Mr. Dowdell has been a mem-

ber of the organization since its early inception, in fact he was one of our charter members.

ON MOTION the Chair is instructed to appoint a Committee to draft appropriate resolutions on the death of Mr. Dowdell.

The Chair appointed as such Committee Messrs. L. H. Turner, R. L. Thomas and F. J. Reeve.

VICE PRESIDENT: We come now to the paper of the evening, the subject being the Steam Turbine, its Principles of Operation and the Results Obtained. All of our engineers have been attracted to the steam turbine of late, and I am therefore very happy to present Mr. L. A. Phillips, engineer of the Westinghouse Machine Company, who will present this subject.

THE STEAM TURBINE.

BY MR. LEO A. PHILLIPS.

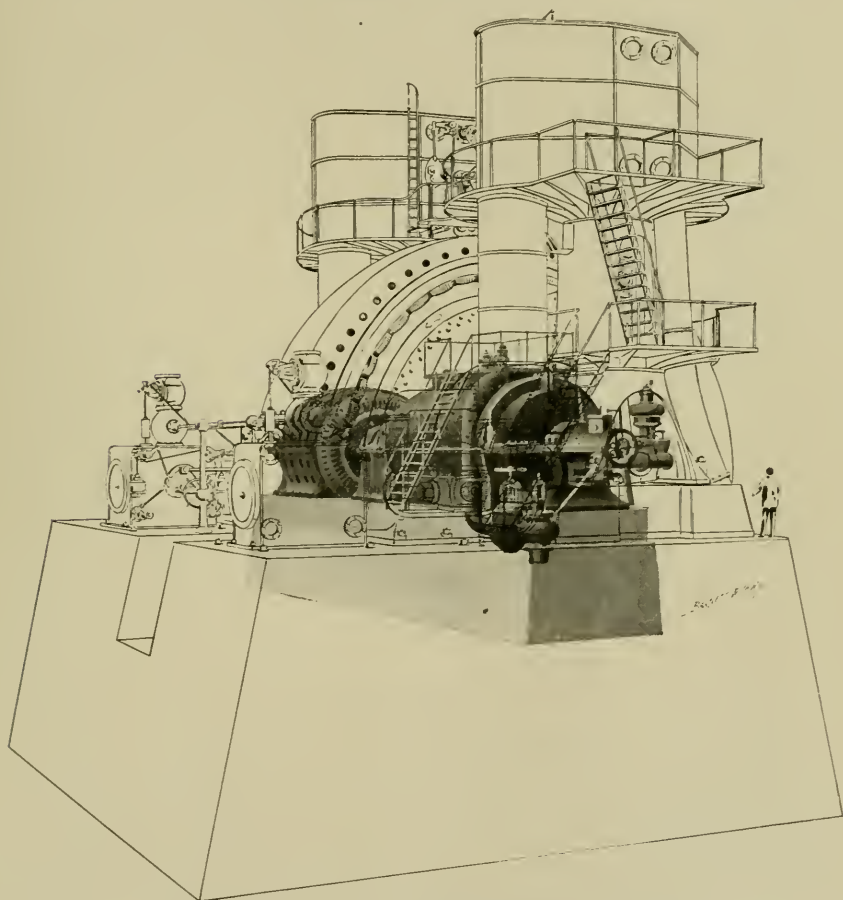
The paper of the evening will refer more particularly to the Westinghouse-Parsons type of turbine.

In endeavoring to cover briefly so much ground as is involved by the main subject of this paper, it is evidently quite impossible to do it entire justice. Many of you are no doubt quite familiar with the general subject of steam turbines. I have therefore thought that the paper could best be devoted to one branch of turbine work—that with which I am closest in touch. It will, therefore, be my object simply to make you better acquainted with a prime mover which is worthy of your most serious thought; one which must be reckoned with in planning a new power house or in enlarging the equipment of one already in service.

The Present Position of the Steam Turbine.

You will perhaps recall in 1900 the great interest the steam turbine aroused by the successful starting of the first American turbine plant at Wilmerding. Looking back over the past five years it is instructive to take a view as it were, in perspective, of the progress that has been made. I shall merely direct your attention to the fact that prophecies which at first seemed exaggerated have already been more than fulfilled.

Firstly, there are already in operation turbine generator units 50 per cent greater in capacity, and with units under construction of twice the capacity of the world's largest engine driven units. A prominent example is the Manhattan station of the Interborough Company, New York City, where 5,000 kw. engine type and turbine type units are now in operation side by side. (The accompanying photograph of drawing to scale



5,000 KILOWATT GENERATING UNITS

Comparison of space occupied and size of foundations. Modern Engine Type Unit and a Westinghouse-Parsons Turbine Type Unit of similar rating and overload capacity.

brings this out impressively.) Such turbine capacities were scarcely dreamed of five years ago.

Secondly, it is safe to say that not a single large power station is now building or being projected in which steam turbines have not either been adopted or seriously considered, and in all parts of the world turbine stations have been erected: In London, Paris, Berlin, Frankfort, Milan, Madrid, Johannesburg, Manila, Sydney, and numerous other foreign cities as well as our great undertakings in New York, Brooklyn, Philadelphia, Chicago, Boston, Pittsburg, New Orleans, Detroit, etc. In London two railway power stations have recently been put into operation, one containing over 20,000 horse power and the other nearly 70,000 horse power in turbines, all of Westinghouse construction. In New York City the Interborough Company was the first to adopt turbines, 1,250 kw. units for lighting the subway and then 5,500 kw. units for extensions to the power equipment of their Manhattan Station. Their example has been followed in the New Brooklyn power station, the great Pennsylvania and the New York Central terminal improvements, and by the Philadelphia Rapid Transit Company where nearly 70,000 horse power in turbine units are already planned for to furnish power to the subway now under construction. The Brooklyn Rapid Transit Company has already purchased five 15,000 H. P. units in addition to the 20,000 H. P. installed, and their Kent Avenue station alone will aggregate over 100,000 horse power.

History of Turbine Development.

Although history is of little practical value to the engineer, it is instructive to glance over the development of the turbine from its very earliest beginning, 120 B. C. It is thus a curious fact that the steam turbine is at once the most ancient and the most modern of steam engines. Hero of Alexandria is credited with the first conception of the reaction turbine which resembles the familiar reaction water motion known as "Barker's Mill." The Italian Branca invented, in 1629 A. C., the impulse motor working upon the same principle of the familiar Pelton water wheel. Both these principles are combined in the modern Parsons turbine as in no other form.

When the Hon. Chas. A. Parsons, twenty-five years ago,

commenced his work on turbines he was confronted by the mechanical problem of enormous running speeds, as high as 40,000 revolutions per minute in small sizes, which are necessary in both the Hero and Branca types to obtain good efficiency. He from the first appreciated the absolute necessity of lower speeds and succeeded finally in obtaining them without gear reduction.

Mr. Parsons produced, in 1884, his first commercial turbine. It developed 10 horse power and consumed 35 pounds of steam per horse power hour non-condensing. With it practically started the modern turbine industry. Condensing practice was begun in 1892, marine work in 1894. By 1902, 800 turbines had been sold aggregating about 200,000 horse power, not including 83,000 horse power in marine service, which has probably doubled by the present time.

Along with Parsons, DeLaval of Sweden developed the purely impulse type of turbine. His genius appeared in the use of a flexible shaft to accommodate enormous running speeds, and the expanding steam nozzle. Later Rateau of Paris, and quite recently Curtis, Stumpf, Zoelly, and a number of other designers have entered the field.

In 1895 the patent rights of the Parsons turbine were acquired by the Westinghouse Machine Company, who, after perfecting the new machine, introduced their product in 1896. Since then over three-quarters million horse power of Westinghouse turbines have been sold in American territory alone, in sizes ranging from 300 to 15,000 horse power.

General Principles.

Up to the time of Parsons and DeLaval steam for power work had been made use of entirely by direct expansion in the cylinders of piston engines. The idea of using the energy of a steam jet to produce power was not new but it had never been put into practice. A fundamental principle upon which the economy of the steam turbine is based is that the available energy in steam jet is equal to that obtained by expanding the same quantity of steam in the cylinder of a piston engine between the same boiler and condenser pressures. Another fundamental idea is that dynamic forces are alone employed and not static forces,

as in the case of the piston engine, i. e., the forces due to rapid motion rather than simple pressure.

Steam versus Water: A clear idea of these principles may be had from the resemblance of a steam turbine and a hydraulic turbine or water wheel. In both forms of turbines nozzles or guiding vanes are used to direct the working fluid against rotating buckets. These buckets are so designed that they will convert the greatest percentage of the total energy of the fluid into useful work. Thus a water turbine or Pelton water wheel is able to take out 85% or over five-sixths of the energy in the water passing through it. The principal reason that we are not able to realize such efficiency from a steam turbine is that we are obliged to deliberately throw away a large part of the original heat in the steam through the exhaust to the condenser.

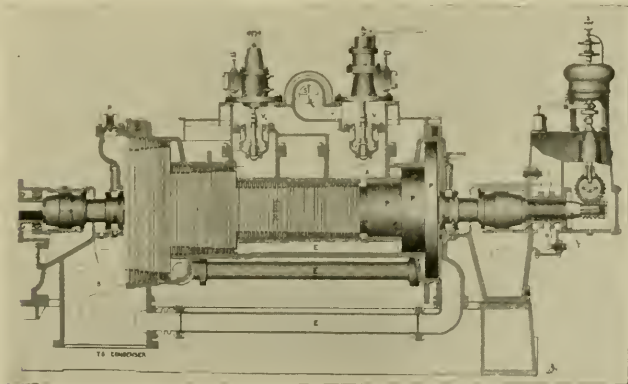
But there is one great difference between steam and water; one is expansive and the other non-expansive. In the steam turbine heat energy is first expanded in producing high steam velocity during expansion. This energy of velocity is then transformed into useful work through the forces of impulse or reaction in somewhat the same manner as a rifle bullet gives up its energy by impact. In the water turbine the energy is taken out of the water at one step. There are no heat losses and only a very small part of the total head of water is wasted, hence its high efficiency.

Now the volume of water passing through a hydraulic turbine is practically constant. Not so with steam; at 200 pounds pressure saturated steam expands 154 times to 28 inches vacuum and 340 times to 29 inches vacuum. Further, the velocity of water is insignificant as compared with that of steam. Expanding through a properly constructed nozzle from 150 pounds boiler pressure to 28 inches vacuum the velocity of a jet of steam is over 4,000 feet per second, or 45 miles per minute.

The Action of Steam in a Turbine Element: The nozzle of a fire hose is gradually narrowed down in order to give the stream of water great velocity and carrying power. Such a form of nozzle cannot be used in steam turbines because steam expands to enormous volumes when the pressure is removed. We must therefore use a divergent nozzle. As the increasing diameter of the nozzle provides room for further expansion

the steam velocity increases and the pressure and temperature fall to that of the condenser. This effect may take place in a nozzle a few inches long and the expansion is nearly ideal. If a bucket wheel were then used to convert the energy of the steam jet into work, we have a complete turbine element which in one form or another enters into every existing type of steam turbine.

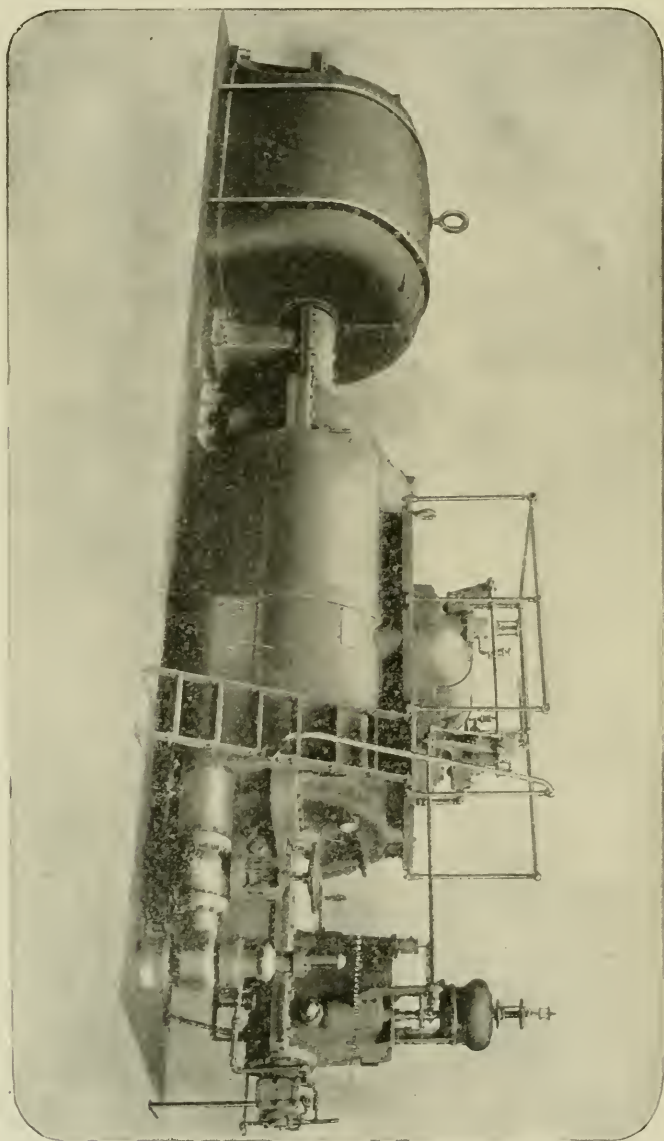
But in this simple form the running speeds are too high to make use of directly. If, now, we should subdivide this simple turbine element into a number of steps each consisting of a small section of the nozzle with its bucket wheel, we find that it is no longer necessary to remove all the velocity and energy of the steam in one step. They may now be distributed between these several steps or stages, in each of which the steam velocities will be much lower. This process is called *compounding* and has been attended with the most success in the Parsons type. It resembles to a certain extent the principles of compounding used in steam engine practice of today. In the present Westinghouse-Parsons type steam velocities have been reduced by means of this principle from the maximum of 4,000 feet per second to a maximum of 600 feet per second. This is so low that commercial running speeds are obtainable with the best efficiencies. Furthermore, wear of the vanes from water in the steam is almost entirely avoided at this low velocity.



Sectional Elevation of a Typical Westinghouse-Parsons Steam Turbine.

Construction of the Westinghouse-Parsons Turbine.

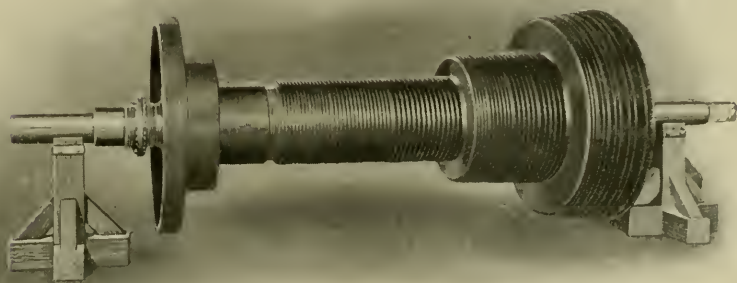
We may now look into the construction of a modern turbine of the Parsons type. The two accompanying cuts show the section and exterior view of a typical machine of Westing-



Westinghouse-Parsons Turbine-Generator Unit of 1,000-Kilowatt rated capacity as it appears when installed.

house construction. The former illustrates two essential elements, a rotor or rotating part, and a stator or stationary cylinder which entirely encloses the rotating part and rests directly upon a continuous bed plate. This cylinder is divided horizontally on a line with the shaft.

Rotating Element: The rotor is built up of several cast



Turbine Rotor.

steel drums forced on to a hollow steel shaft. Upon these drums are mounted rows of buckets or vanes projecting radially outward from the surface and alternating in position with similar rows of vanes projecting inwardly from the stator. The rotating blades move within the cylinder with just enough clearance to prevent contact; there is therefore no friction. Through the circular port A steam is admitted in puffs from the poppet valve V. This steam expands to the left through the area between the rotor and stator, finally passing directly downward to the condenser through the exhaust opening B. Observe that this area gradually increases from inlet A to exhaust B, the length of the blades likewise increasing. This is simply to accommodate the expansion of steam as the pressure is lowered.

You will further notice that three different diameters are employed for the rotor drums. It is theoretically possible to provide for steam expansion to any vacuum by simply increasing the length of blades on a drum of uniform diameter, but the number of different sizes and lengths of blades would be great

and the longer blades would be very weak. By abruptly increasing the diameter at certain points we largely reduce the number of necessary blade sizes, at the same time increasing their stiffness. This change of diameter therefore is purely for mechanical convenience and does not correspond to the three stages of a triple-expansion engine. Each row of blades forms one stage in the total expansion range.

On the other end of the shaft opposed to these three blade drums are mounted three rotating balance pistons P, of corresponding diameters. By means of pressure-equalizing pipes E, E, E, the force of the steam expanding to the left against the various rows of blades is exactly balanced by the thrust to the right against the balancing pistons. Thus, whatever the boiler or condenser pressure or the load, the rotor always runs in perfect balance or equilibrium and no work is placed upon the adjustment bearing T, which is used simply to keep the rotor in a fixed position so that the moving and stationary blades will not collide. This is not difficult, for the side clearance between blades is from $\frac{1}{8}$ to 1 inch in the largest sizes.

Blades or Vanes: Imagine a number of turbine water wheels arranged one after the other upon a single shaft, the system operating under a very high head of water. Tail water from the first turbine is delivered to the inlet of the second and so on through the system, each turbine removing from the water a certain part of its total energy. Such an arrangement very closely resembles that of the Parsons type. Each ring of stationary vanes gives direction and velocity to the steam; the following ring of rotating vanes immediately absorbs this energy of velocity, at the same time expanding the steam a little further. Step by step the steam is thus lowered in pressure and temperature to that of the condenser.

The essential difference between the Parsons and the De-Laval (or Pelton) types of turbine is that in the Parsons no steam nozzles are used. The entire expansion is performed between the vanes themselves and the resulting velocity is absorbed as fast as it is generated. It is thus that the average steam velocity through the turbine is kept so very low.

If it were possible to trace an indicator card of the steam

turbine we should find that the expansion line was carried right down to condenser pressure, that is, there would be no "toe" to it as in an engine card. It is seldom that the most economical steam engine expands further than to 5 or 6 pounds absolute pressure. Assuming a working range from 150 pounds boiler pressure to 28 inches vacuum this means that about one-fourth of the total energy of the steam is deliberately thrown away into the condenser. If the expansion is stopped at atmosphere one-half of the energy is thrown away. The ideal construction of the turbine has made it possible to continue the expansion down to condenser pressures and thus regain the 25% of work lost in the steam engine. In fact, it is so easy to do this that turbines are now constructed to operate simply on the exhaust of non-condensing steam engines.

The turbine vanes are drawn through steel dies into long strips and cut to the required length. They are then assembled in grooves turned in the opposing surfaces of rotor and stator and caulked in position. This process makes it an extremely simple matter to make repairs in case of accident to the blading. Their complex curvature represents the result of both experiment and many years' practice.

Glands: Both shaft openings through the stator are sealed by frictionless water glands. These resemble small paddle wheels fastened to the shaft, and maintain under slight pressure a ring of water in grooves in the casing. This water furnishes the seal. Air cannot leak in to impair the vacuum nor steam leak out when the turbine is running non-condensing.

The glands require no oil, and as none is used in the turbine itself absolutely no oil can get into the exhaust steam, which is therefore pure water and may be returned directly to the boilers instead of being wasted as is frequently done. The little water necessary for sealing finally finds its way into the condenser.

Bearings: When a body such as a turbine rotor is run at speeds as high as 3000 or 3600 revolutions per minute some form of cushion bearing is desirable to absorb and dampen the vibration which occurs when the machine is being speeded up.

In smaller sizes of turbines special cushion bearings are used. Each consists of several loosely fitting concentric bronze shells which are continually flushed with oil from a small pump driven by the turbine. The oil films between these shells provide the cushioning effect. In the larger machines which run at speeds below 2000 revolutions per minute this cushioning is no longer necessary and the usual ball and socket type of bearing is used.

In all sizes the bearings are proportioned liberally enough so that the entire weight of the shaft may be supported upon the oil films without the necessity of oil under very high pressures; simply that due to the weight of a column of oil a few feet in height. There is practically no wear on the bearing shells for the reason that journal and bearing never come in contact. Furthermore, oil, if it is of good quality, may be used over and over again for months at a time without change. In many plants it is customary to draw off a bucket of oil once a month for use in other machinery, replacing with fresh oil.

Governor: A unique system of governing is used which differs largely from that on any other form of turbine. In several types of turbines now in use steam is simply throttled down to a lower pressure according to the load, as in a throttling steam engine. In another type the governor uncovers one nozzle after another as the load increases, steam always being admitted at full boiler pressure. Although this is an advantage, it is unfortunate that in this type only a small portion of the circumference of the turbine wheel is ever in use. The idle portion of the wheel, therefore, simply acts as a drag or brake upon the turbine, reducing its efficiency.

You can readily see from the sectional drawing that in the Parsons type there are no idle buckets, as steam fills the entire space between rotor and stator. Steam enters the turbine, not in a continuous stream throttled according to the load, but in short puffs and always at full boiler pressure. The more power to be developed the longer the puff. This effect is controlled by a sensitive centrifugal governor which is kept in continual motion by the valve mechanism so that it never has an opportunity to get stuck. Speed regulation is therefore very sensitive, as low as 2% if desirable.

For loads up to rated capacity the primary valve *V* controls all steam admitted to the turbine. On overloads a secondary valve *V* gradually comes into play under the control of the governor. This valve admits high pressure steam to the lower stages of the turbine, more than doubling its capacity. Thus under normal loads the turbine can operate at its best efficiency and still have enormous overload capacity when necessary.

As the best governing mechanisms are liable to injury a small automatic speed limit governor is provided on the turbine for the purpose of increased safety. This governor instantly shuts off the main steam supply when the speed reaches a dangerous point.

Generator: The standard turbo-generator is in general of the same construction as the standard engine type generator. It is, however, completely enclosed and operates practically noiseless and is of extremely small size owing to the comparatively high speed. As an instance: The 5,000 kw. engine type generators at the Manhattan station, New York, are approximately 42 feet in diameter, running at 75 revolutions per minute. The 5,500 kw. turbo-generator in the same station is approximately 14 feet in diameter, running at 750 revolutions per minute.

Performance.

In speaking of the relative economy of a steam turbine or in drawing comparisons with other turbines or with steam engines it is very necessary to state under what conditions the results have been obtained. Since the turbine has come into use superheated steam and much higher vacua than we have been accustomed to have been developed as a means of increasing economy. These means have become popular on account of the comparative ease with which they may be adapted to steam turbine work.

Furthermore, the power developed by steam turbines may only be measured at the shaft or generator terminals, as there is no method of "indicating" the turbine. The uncertainties of indicator measurements are, however, avoided. It must then be borne in mind that turbine water rates are always expressed

in terms of Brake horse power, Electrical horse power, or Kilowatts actually developed, and in order to reduce these results to a basis of Indicated horse power for comparison with the steam engine we must multiply them by the efficiency of the engine or engine-generator unit under consideration. For a modern high grade steam engine the efficiency usually ranges between 90 and 94%, while for a corresponding generating unit the over-all efficiency ranges between 85 and 90%.

Every turbine built at our works is subjected to a series of duty tests before shipment. The tabulated data shows the results of such a series of tests upon a 750 kw. turbine, under the following conditions:

- A Saturated Steam, Non-Condensing.
- B Superheated Steam, Non-Condensing.
- C Saturated Steam, Condensing.
- D Superheated Steam, Condensing.

(See Table. Page 121.)

Several interesting points are brought out by these tests:

Firstly, the curves of total water consumption are practically straight lines. This means that turbine losses are constant, i. e., they do not increase with the load.

Secondly, the curves of water rate are extraordinarily flat within wide ranges of load, i. e., the water rate does not vary greatly under different loads. Thus the turbine is able to show excellent results on very fluctuating loads. You will observe that the water rate at $\frac{1}{2}$ load is nearly the same as at 100% overload and that the total variation within this range is but $1\frac{3}{4}$ pounds per brake horse power hour, which is about $12\frac{1}{2}\%$.

Thirdly, the economy on heavy overloads is excellent; in fact, as the overload valve comes more and more into play the water rate actually becomes better and better, as you can see by the bending over of the water rate curves. This characteristic is very different from that of the steam engine. As you well know, its water rate increases rapidly with the overload. In this test of a 750 kw. turbine the overload was carried to 2147 horse power without the least signs of distress.

Capacity, kilo-watts.....

Average Vacuum in Exhaust.....

Av. Press. lbs. per sq. in. at thro. gauge.....

Average Condition of Steam.....

Average Speed, Revolutions per Min.....

Turbine Number.....

Pressure, lbs. per sq. in. gauge.....

Vacuum, referred to 30" barometer.....

Superheat, degrees Fahrenheit.....

Quality of the Steam.....

Revolutions per minute

Load in Kilo-watts.....

Load in electrical horse-power.....

Total lbs. steam per hour.....

Pounds of steam per B. H. P. hour

750 KILO-WATTS

0 Inches		28 Inches		28 Inches	
140 lbs.	150 Lbs.	150 Lbs.	100° Superheat		150 Lbs.
Superheat	100° Superheat	Dry and Saturated	100° Superheat		
1,800	1,800	1,800	1,800		
59	59	59	59		
140.1	153.5	155.5	149.4	149.5	149.8
7.18	93.94	96.68	85.33	27.97	28.01
1,771	1,776	1,787	1,760	1,809	1,811
				1,812	1,817
				1,788	1,798
				1,792	1,770
				1,804	
1,074.7	761.1	397.7	1,544.6	1,126.1	811
30,371	18,308	12,065	36,248	15,507	11,759
28.26	24.06	30.33	23.46	13.77	14.49
				15.52	19.89
				12.99	13.27
				15.32	13.91
				12.38	

You will observe that the turbine reaches its best economy at about full load. As the rating of the turbine is the same as that of the generator, the best efficiency is obtained from the unit. On the other hand, the best economy of the steam engine as it is usually rated occurs at about three-fourths generator load, so that at this point the generator is 25% below rating. Thus the best efficiency of the engine type unit can never be obtained. In practical terms this means that less turbine power machinery is required for a given plant load, that is, the effective capacity is greater.

A good example of what economy can be obtained, from a small machine, is afforded by the results of a test made by Messrs. Dean & Main of Boston upon a 400 kw. Westinghouse-Parsons turbine. Twenty-eight inches vacuum was maintained throughout. At full load a water rate of $13\frac{1}{2}$ pounds per brake horse power hour was obtained with saturated steam. By superheating the steam 182° F. this water rate was reduced to 11.17 pounds.

Assuming an engine efficiency of 90% this is equivalent to about 10 pounds per indicated horse power as we usually speak of it in engine practice.

You will no doubt wonder whether these economies will not fall rapidly with low vacuum or with none at all. The curves before you show that the water rate is about doubled when running non-condensing. Without either vacuum or superheat $22\frac{1}{4}$ pounds per brake horse power hour was obtained. This is certainly excellent in view of the fact that the turbine was designed entirely for condensing service. Designed for non-condensing work it could do much better, just as an engine with the proper cylinder ratio.

There is no doubt, however, that high vacua and superheat are to a certain extent desirable, particularly the vacuum. By using 140° superheat and increasing the vacuum 3 inches the water rate of a 1500 kw. turbine was reduced 23%. In round numbers, every additional inch of vacuum above 25 or 26 inches decreases the water rate by 3 to 4%, depending upon the load. High vacuum is always more essential at light loads than at

heavy loads, which is fortunate, as a condenser will usually give a better vacuum when the load is light. Similarly the 100° superheat will decrease the water rate about 10%, independently of the load. The effect of a variation in steam pressure within a range of a few pounds is negligible. A rise of 50 pounds above the usual pressure of 150 pounds will, however, be appreciable—about 4%. But on account of the increased cost, danger and trouble of higher pressures this evidently has very little influence in determining the working pressure.

Condensers: We hear much about the supposed difficulties in maintaining a high vacuum, for instance 28 inches, with present types of condensing equipments. I have no hesitation in saying that they have been greatly over-estimated. A vacuum of $28\frac{1}{2}$ inches is entirely practicable. The secret lies in getting rid of air which finds its way into the condensing system from many sources—through the feed water and steam, through air leaks in piping, and through poorly packed stuffing boxes. In most modern condensing systems a separate “dry” air pump is used independent of the usual “wet” pump. This arrangement has apparently solved the difficulty. In one plant a vacuum of 28 inches has easily been obtained with the simple ejector type of condenser which costs only about \$2.00 per kw. of turbine capacity.

The power consumed by high vacuum condensing auxiliaries has also been greatly over-estimated. In one of our turbine plants—that at Johnstown, Pa.—the air and circulating pump required but $2\frac{1}{4}\%$ of the power developed by the turbine at full load and only 5% at one-seventh load. Data recently obtained from British turbine plants at Neepsend, Bromwich and Manchester show that an average of $2\frac{1}{4}\%$ of the total power generated is required for the condensing plant with an average vacuum of $27\frac{1}{2}$ inches. The amount of cooling water to be handled, of course, depends to a considerable degree upon the temperature of the supply.

Although any efficient type of condenser is entirely suitable for turbine work, the surface condenser has become popular on account of the fact that the condensed steam may be re-

turned in a pure state to the boilers, thus reducing to a large extent the cost of cleaning and maintaining the boilers and purifying the feed water. In large cities where water is expensive, such as New York (where the prevailing price is 10 cents per thousand gallons) the saving in water also becomes an important item. With coal costing \$4.00 per ton it can be shown that an increase of vacuum from 26 to 28 inches will pay for itself in less than a year with good load conditions and in two or three years with poor ones.

It is evident to you that a long exhaust pipe causes a loss in vacuum due simply to the friction of steam in the pipe. Appreciating this the Manhattan Railway Company deliberately discarded their jet condensers, which were located in the basement of their power house, and installed elevated jet condensers connected directly to the engine exhaust. This practice has also been carried out in the Interborough plant, New York. An important feature of the Westinghouse-Parsons turbine is that the condenser may be located directly underneath the turbine or opposite it, the connection between condenser and turbine being short and of sufficient size to get rid of the drop in vacuum. This accomplishes the same result as the Manhattan arrangement with much greater compactness and ease.

At Piedmont, W. Va., the condensers are located directly below the turbines so that no extra space is required for them. Each 1,000 kw. turbine unit is supported upon two rows of 8 inch C. I. pipe columns. It is interesting that this arrangement cannot be employed with any other form of prime mover, although in several vertical turbine arrangements the turbines are mounted on top of the condenser casing which has to be made much heavier in order to support the extra concentrated weight.

Commercial Features.

There are many features through which the steam turbine commends itself to the commercial man outside of these which are of greatest interest to the engineers, and we may well conclude our thoughts upon this subject with a brief discussion of them:

Economy: This we have already considered in detail. It appeals to the commercial mind more in the rate of disappearance of the coal pile than in a statement of water consumption per horse power hour. The Yale & Towne Manufacturing Company has found that during the regular operation of their turbine plant an average of only 20 pounds of water was used per horse power delivered at the motor pulleys in the various parts of the factory. By actual weight this corresponded to 2.39 pounds of coal per horse power hour at the motor pulley. A recent test of a 3,000 kw. turbine plant at Sheffield, England, showed an average steam consumption over five months' continuous service of 22.41 pounds per kw. hour output, which corresponded to a little over 2.6 pounds of coal per kw. hour; this with an average of but two-thirds load on the turbine. The latest returns from the Newcastle-on-Tyne turbine plant, one of the largest in England, show a total cost of power for the year 1905 of but 0.58 cent per kw. hour sold to customers; this on a load factor of only 22%. It is the lowest figure yet recorded for electric lighting stations in Great Britain. It comprises all power house expenses, including maintenance on cables, pole lines, and consumers' meters. As the loss in distribution is at least 15%, and more likely 20 to 25%, the actual cost of power is .45 cent per kw. hour generated.

Permanence: Does the turbine maintain in service the high economy it undoubtedly possesses at the start? A good case on record is that of a 500 kw. turbine tested by Prof. Ewing in daily lighting service for twelve months. This turbine showed an economy of about 18 pounds of steam per electrical horse power hour with the conditions under which it later operated at the plant. A year later it showed 18.6 pounds, but the turbine was driving its own air pump, whereas the pumps were independently driven at the shop tests. The small difference—3%—indicates no less of economy with time. This is reasonable, for you will recall that in the turbine we have no complicated valve gear to wear out and lose adjustment, no piston and valve leakage, no internal rubbing surfaces to set up friction, and very little opportunity to get out of alignment. The adjustments which are made at the start are permanent and the blades do not wear owing to the low steam velocities.

Reliability: We all appreciate the necessity of having an engine that we can depend upon to run day in and day out for years. Long shutdowns are one of the most dreaded catastrophes that can happen to a power plant manager. I invite your attention to the simple and rugged construction of the turbine as the most important source of the reliability which we so much desire.

The 600 horse power turbine on exhibit at the Louisiana Purchase Exposition ran through the Exposition—3,962 hours—under widely varying load without closing the throttle. A German-built Parsons turbine of the same size was put into service at a mining pit in Silesia April 13, 1902. The turbine ran 17,200 hours out of a possible 17,500, that is, day and night for two years. The seals which were originally put on were broken April 24, 1904, in the presence of seventy engineers. The interior blades were found in perfect condition and not the slightest trace of wear. A 400 kw. Westinghouse-Parsons turbine ran in a railway and lighting plant 505 days on 24-hour service without being opened for inspection until the close of this period. No deterioration was then noticed. During erection this turbine slipped from its staging and fell six feet to the ground landing bottom side up without sustaining any damage. Another turbine of the same size on 24-hour railway service ran 375 days with less than 1% shutdown chargeable to the turbine.

At Newcastle, England, the station log shows the following record: Out of 7,512 hours' run—from December, 1901, to December, 1903,—a Parsons turbine was out of commission but 52 hours or 0.7% of the running time. With you who are connected with or interested in power plant work, these facts should start a train of thought.

Simplicity: A machine that consists of but two main parts—stator and rotor—one that is entirely self-contained and one in which there are no adjustments to be constantly looked after cannot be very complex; yet some skeptics have tried to make a case out of the numerous blades with which the turbine is equipped. I would emphasize the fact that in their numbers lie their greatest excellence of construction, for a little damage

can be readily repaired, whereas with a construction employing milled buckets the slightest injury would necessitate the discarding of the entire section of the turbine, to say nothing of the trouble in dismantling the machine to remove it.

When trouble occurs, as it sometimes does in the best machinery, it is imperative to make temporary repairs and keep running until regular periods of shutdown. Here is a case in point. On account of the omission of an expansion joint between turbine and condenser one of our turbine casings was distorted sufficiently to destroy a few rows of blades. The casing was removed and the broken blades cleared away within an hour's time. The turbine was again put under steam and carried full load for the rest of the day without trouble or apparent effect upon its capacity. During the following nights, after new blading had arrived from the factory, the machine was again opened and the damaged rows replaced. Another turbine damaged by water backing up into the exhaust pipe ran over six weeks with several rows of blades out until the engineer could find it convenient to replace them.

Most of you would consider it very rapid work, if not impossible, to erect a 500 horse power engine and put it to work within a week, even with crane service. Yet a 500 kw. Westinghouse-Parsons turbine may be placed in operation within three days of delivery if necessary, provided steam and exhaust connections are ready.

Any turbine operator will tell you how easy it is to run turbines. They frequently complain of the tediousness of their "do-nothing" job. From this it must not be inferred that a turbine operator does not need good mechanical knowledge, for when machinery requires it such knowledge must be of intelligent character.

Compactness: Space costs money; not only in increased ground area but also in larger and heavier buildings. Compactness is therefore very desirable. A power station using Westinghouse-Parsons turbines, if properly laid out, need not require more than $\frac{1}{4}$ to $\frac{1}{2}$ square feet per kw. for the operat-

ing room, according to the size of the plant. The latter figure is but one-fifth of the space required for a horizontal Corliss engine unit of equal capacity. At full load over 10 electrical horse power per square foot of floor space occupied is developed by a large Westinghouse-Parsons turbine.

A point of interest is brought out by a comparison of turbine plants which have recently been built employing the horizontal and the vertical types of turbines respectively. An average of four stations of each type ranging from 2,000 to 50,000 kw. capacity shows that the vertical plant occupies 70% more space than the horizontal turbine plant for the operating room alone, and over 35% more space for the horizontal for the entire power house. The greater space required for the vertical type is apparently due to the floor area necessary for the auxiliaries which cannot be located beneath the foundations. At the Boston Edison station the auxiliaries for each turbine unit occupy a block approximately ten times the floor space of the turbine itself, even though it is mounted on top of its condenser.

With the Parsons type of turbine foundations become a simple matter. Any support strong enough to sustain the dead weight of the machine is sufficient. Nothing in the nature of foundation bolts is required to hold the turbine in position, as there is no vibration or thrust to tend to displace it, consequently turbines may be mounted on structural steel floors or galleries. (The foundations at Piedmont mentioned above are good examples.) Another plant has been constructed in which the turbine equipment is placed on the second floor with the boilers beneath, and several installations have the turbine units supported on steel and concrete columns.

Speed Regulation: A great majority of modern power plants employ alternating current apparatus exclusively. Parallel operation of alternators is therefore an important subject. Those of you who have had experience with engine driven alternators can appreciate the difficulties and skill required for successfully paralleling two units. With steam turbines this becomes an extremely simple operation, for the rotation is absolutely uniform and speed regulation is all that can be desired. In all Westinghouse-Parsons turbines there is an adjustment

(sometimes operated by hand and in large machines by a small motor controlled from the switchboard) which changes the tension of the governor spring. By this means an idle unit can readily be "brought up to speed" for paralleling and the load distributed between two alternators when operating together. Sensitiveness of speed regulation can be controlled to a nicety by means of a small dashpot adjustment.

In plants where turbine and engine units are running together the regulation of the entire system may often be improved by so adjusting the turbine governor that it will absorb the greater part of sudden load fluctuations, thus leaving the engine units to take a comparatively uniform load. This it can readily do on account of its great rotative inertia. This plan has been carried out with great success at the Manhattan plant, New York City, also at the B. F. Goodrich turbine plant at Akron, Ohio, where two turbines and three engines, all of different sizes, operate in parallel, the larger turbine being so adjusted as to absorb the sudden peaks on the system.

Cost of Equipment and Operation: Finally, I will emphasize the fact that at the present time, notwithstanding a keen competition among engine builders, a steam turbine equipment complete with its condensing plant costs less in dollars per kw. capacity than a similar engine equipment of equal capacity and grade of workmanship. Add to this the decrease in cost of land and buildings, in foundations, in boiler house capacity, in labor, supplies and general upkeep. We then have a measure of the comparative cost-efficiency, as we might term it, of the two types of stations.

It is difficult to obtain accurate data covering only the costs which we wish to determine. Here are two cases, however: Mr. Parsons reported on April 8, 1903, that after eleven years of service the Newcastle plant had a total repair bill of only .22c per kw. hour, while the average of British plants is .62c per kw. hour. The actual cost of power from this plant has already been given. In the 1,600 kw. plant at the works of the Westinghouse Air Brake Company near Pittsburg, which has been operating since 1899, the average oil consumption for

the last year was eleven barrels. The amount of oil used averaged 0.000165 gallons or .00675c per kw. hour. As this oil was used again in the slow speed machinery the actual expense for the turbine plant is still less and is actually charged at 0.0034c per kw. hour. The item of repairs for this turbine equipment of about 2,500 nominal horse power averaged during the last two years \$165.80 or 0.00642c per kw. hour output.

The facts which I have presented to you would seem to command respect for the turbine as a machine of wide application, rugged and permanent in construction, responsive to sudden and heavy demands, and capable of giving commercial results under very unfavorable conditions. Its many excellent features have frequently been taken advantage of in a manner which should not be tolerated in a power plant worthy to be equipped with such refined and modern apparatus. It is not in the makeshift plants that the turbine can do its best work. In many cases it has had to be designed to accommodate existing conditions in the plant. To-day the reverse is true; the plant is now being designed for the turbine, and the more universal this practice becomes the more marked will be the influence of the turbine in general power station practice.

In many respects the turbine and reciprocating engine are now upon equal footing. Even if first cost of turbine alone were the paramount issue, in view of the many additional advantages and sources of economy which the turbine presents, we could deliberately expend much larger amounts for equipments with the assurance that the costs would soon be wiped out in actual service.

The steam turbine, therefore, may be commended to you from all its phases, not only from the standpoint of the engineer and the practical operator, but also from that of the capitalist. Complete familiarity with it will alone give full appreciation of its merits.

VICE PRESIDENT: Gentlemen, Mr. Phillips has laid before you a very able paper on a most interesting and important subject. I hope we have a number of mechanical men with us tonight who will take part and discuss this subject thoroughly.

MR. JULIUS KRAUSE (P. R. R. Inspector): Gentlemen, In reply to Mr. Phillips' excellent address in reference to turbine steam engines, I wish to give my experience, as Mr. Phillips states he saw a turbine engine dropped 6 feet without injury. When the Westinghouse Machine Company first began manufacturing turbine engines I was asked to go to their works at East Pittsburgh to load a turbine engine weighing 86,000 lbs. I selected a fine steel 100,000 lb. capacity flat car and had the Westinghouse Machine Company construct a frame well braced and fastened down on car for turbine engine to rest on. The car was started on its journey. When it reached the Pitcairn Yard the car was classified and allowed to strike cars standing on same track. This caused the bracing to give away, and the engine slid off the car down on the track. It fell about four feet and was damaged some. I was very much interested as to how much it cost to make repairs. The engine was taken back to East Pittsburgh and was taken apart. I was anxious to see the blades and found a number bent; and when the P. R. R. received the bill for damage done—my bracing was criticised by my superior officers, and my advice is not to drop turbine engines.

MR. LEO A. PHILLIPS: If that had been a Corliss engine that dropped four feet it would probably have damaged same to a greater extent.

VICE PRESIDENT: We will be glad to hear from Mr. Van Blarcom.

MR. H. VAN BLARCOM: I had not expected to speak this evening. But if there is any information that I may happen to have I will be glad to give it to you. In a general way I think I know the history of all the plants and the behavior of the machines in them, and if there are any points you gentlemen would like to inquire about I might be able to answer your questions.

MR. F. J. REEVE: I would like to ask as a matter of information at what pressure is the steam introduced into the turbine?

MR. L. A. PHILLIPS: The steam is admitted at full boiler pressure. And the turbines are designed for working pressures of 125 to 200 lbs. per square inch. That is, any of the units will develop their full overload capacity at 125 lbs. steam per sq. inch. The castings and valves are all designed for 200 lbs. per sq. inch, and with superheat you get your rating anywhere between those two. The primary admission valves are for boiler pressure. Steam is admitted in short puffs and then allowed to expand. As the load increases the duration of the opening or of the puff becomes larger, until at overload the primary valve is practically open all the time.

MR. A. W. PATTERSON: I would like to ask what would be the effect of a dose of water upon a turbine when operating at full speed?

MR. VAN BLARCOM: I was sitting on the platform of a 1500 kw. turbine within the last sixty days at a new plant that had not got their steam piping in final shape, and a slug of water came over of such volume that the turbine came almost to a standstill. You could feel the pipe jar, yet there was no damage to the turbine, although it brought same to a standstill in ten or fifteen seconds.

MR. PATTERSON: Do you use a separator?

MR. VAN BLARCOM: We recommend the use of separators. We do not advise running wet steam through the turbines because the machines are not designed for that. We advise the use of separators just before the steam enters the turbine.

MR. L. A. PHILLIPS: We have had instances of the condensers filling where the condenser was located above the turbine floor and the condensation backed up on to the lower rows of blades and pulled the turbine down in speed and it did not injure the blading at all.

MR. HAMPTON: A club of this kind must contain some locomotive engineers. Now most any engineer is concerned about whether his engine is cutting off square or not. In fact,

it has been known that engineers will pull their engines in on three legs. I would like to ask Mr. Phillips what are the prospects of replacing the locomotive with the turbine, through the use of electric motors?

MR. L. A. PHILLIPS: The New York, New Haven & Hartford road is just about ready to put their single phase locomotives in operation, which will be driven with 3,000 or 4,000 kw. turbines, and the New York Central & Hudson River R. R. have just started up their New York terminal division with motor operated trains, receiving their current from turbine stations.

MR. A. A. ROGERS: The part of the turbine operation that will particularly appeal to railway men is its flexibility, its ability to meet overload and underload and at the same time not exhaust its boiler supply. I know in my experience in power houses of railroads the boiler supply end of the proposition was a little underrated, that is, a man buys three or four boilers when he needs six or eight, and the reciprocating engine possibly could not give him this overload capacity or will not respond to the lower changes in the proportion to which the turbine will. This turbine, with its auxiliary valve opening up automatically and enabling you to carry your enormous overload, it seems to me is particularly adaptable to those fluctuating loads which occur around a railway plant.

Another thing which is of particular service to a railway man is continuous service. The loss of time and loss of money due to shut downs is, of course, a very important matter. With these turbines in the power house the operation of the plants which we have in service demonstrates that the turbine is superior to other apparatus in this particular. It keeps going and it will go all the time. The feature which appeals to the practical plant operator is the fact that there are no adjustments to be made in this machine, practically, after it is put into first-class operation. In your reciprocating engines you have to key up, and it is a question there of the man doing that right, and keeping his valves in proper shape, or he gets a hot box and has some other troubles.; and if he does not do it at all it is operated

at the expense of his coal pile. The turbine, having very small wearing surfaces, or in other words, having a very small pressure per square inch of bearing surface, has very little wearing on the bearings, practically none. The turbine rotor floats in a flushed oil bearing and therefore there are no parts to take up. When it is put into operation it is there to stay.

MR. O. E. ANDERSON: I have had occasion in the last few months to look into the question of power plants for office buildings, and I would like to ask whether comparison could be made of the turbine with gas engines and reciprocating engines for work of that character.

MR. L. A. PHILLIPS: The steam turbine is essentially a condensing machine, and we have not done very much in the way of developing a non-condensing engine of small size for office building work. Some of our competitors have brought out a small non-condensing engine, but we have not gone into it to any great extent; we have been too busy with the condensing turbines. The smallest machine we build is 300 kw., and that is rather large for office building work. I think in the next year there will be a number of machines on the market that will give satisfactory service.

MR. O. E. ANDERSON: Would you recommend that, as against a Westinghouse gas engine, for instance?

MR. L. A. PHILLIPS: Not where you can get natural gas for ten or fifteen or twenty cents. You cannot compare with the gas engine in economy with gas at prevailing prices.

MR. CHAS. A. LINSTROM: There are unquestionably points in favor of a rotating engine as against a reciprocating engine. In the first place, there are no reciprocating parts that have to be balanced. There is no fly-wheel, with constant danger of breaking into pieces and killing people.

Another point that has not been brought out: A turbine or rotating engine has no dead center. It can be started immediately as the steam is put on, which is not the case with reciprocating engines. Still another point: It has very little

if any vibration. It can be placed on a foundation without bolts. That is a very important point in their favor in power stations and office buildings. You all know the trouble reciprocating engines give in large office buildings, in which the vibrations can be felt from the foundation to the top of the building. It is unquestionable that the turbine is the coming steam engine, and in a comparatively few years, in my opinion, there will be very few reciprocating engines built.

MR. L. A. PHILLIPS: Supplementing above regarding quick starting, I would call your attention to the fact that in the Pennsylvania & Long Island power house with the 5,500 kw. units, practically equivalent to a 10,000 horse power Corliss engine, they have been started up from a cold engine, standing still, to full speed and working on the main bus within 50 seconds. That would be absolutely impossible with a Corliss engine of corresponding size.

MR. O. E. ANDERSON: Will a turbine engine ever be applicable to a locomotive?

MR. L. A. PHILLIPS: I do not think so, directly. The way to run the locomotive is to have the turbine stationary and condensing and operate the locomotive electrically, the same as the New York, New Haven & Hartford are now doing. They are preparing to run their whole system within forty miles of New York with steam turbines and electric locomotives, and eventually the entire road.

MR. O. E. ANDERSON: I would like to ask how they take up the end movement in the shaft of the turbine?

MR. VAN BLARCOM: When we once set the turbine spindle properly there is no occasion for changing that adjustment. It is possible to change it, but when it is once properly set the necessity for changing it is very, very slight. It may run for a couple of years without ever being changed. There is a little hand wheel adjustment so that you can move the spindle either way and set it any place you want within the permanent limitation. But there is no wear endwise.

MR. O. E. ANDERSON: We have had occasions where the vanes would be torn out of the rotating element.

MR. VAN BLARCOM: Certainly we have had vanes torn out. I know of one case where an operator was trying to gain knowledge of the turbine in very much the same way that a small boy gets a new watch and takes his jack-knife and opens it up to find out what is inside. The chief operator was not there and this man did not know what those adjustments were, and he juggled the machine around until he shifted the spindle beyond its position, and the blades he finally got in contact side-wise. There could not be any other possible result than to tear them out. Unless there is some abnormal condition brought about through ignorance, the blades will not collide sidewise. There is from $\frac{1}{8}$ " to $\frac{1}{4}$ " clearance sidewise between the blades and the spindle has an oscillating movement between five and ten thousandths, so there is no legitimate reason why they should get out.

MR. L. A. PHILLIPS: I would like to supplement Mr. Van Blarcom's remarks by stating that the end thrust is practically balanced throughout at all times. The three balancing pistons absolutely equalize the three sections of the blading; consequently, the turbine rotor has scarcely any end thrust, so that all the thrust bearing has to do is maintain the proper adjustment.

MR. A. A. ROGERS: Will you please explain the action of the thrust blocks. I do not think that is quite clear to the gentleman.

MR. VAN BLARCOM: At one end of the spindle there is an adjustment bearing to hold the spindle in its proper position actually. It is called a thrust bearing simply because it corresponds in its form to the thrust bearing on the propeller shaft of a ship. There is not and should not be any appreciable end thrust on the machine. It runs perfectly balanced from no load to over-load without any end thrust, or if there is, it is so slight that you can move the adjustment screw with your hand. It is negligible. I have known those blocks running three years

in ordinary commercial service and no appreciable wear detected.
(Explains in detail from slide on screen.)

I mentioned a while ago about an operator fooling with that adjustment and shoving the spindle and taking out some of the blades. To prevent that we now put a lock on the thrust screw which is set by our own men when they leave the machine, and it is impossible to tamper with that now unless they stop the machine and take off the governing case to unlock it. You have to take off that whole bearing case now if you want to change the adjustment. Now we would not build the machine and leave it that way if there was any necessity for adjustment.

MR. O. E. ANDERSON: Do you use what corresponds to cut-off in a reciprocating engine?

MR. VAN BLARCOM: No; it is practically a steady pressure all the time. The steam is admitted through the valves in little puffs; as the load increases the length of time the valve is open, or the length of the puff, is increased, until at full load it is open all the time.

MR. O. E. ANDERSON: Is it the speed of the steam or the pressure that produces the effect?

MR. VAN BLARCOM: It is a combination of the two, both impact and reaction.

MR. ———: Something in the paper led me to understand that the non-condensing turbine is less economical than the condensing reciprocating engine. Is that correct?

MR. VAN BLARCOM: The non-condensing turbine is a little less economical than the highest type of non-condensing reciprocating engine. Of course, you have a good many non-condensing compounds that the turbine will excel in economy, but the highest type of non-condensing reciprocating is a trifle more economical than the turbine running non-condensing.

MR. CHAS. A. LINDSTROM: Does that mean indicated horse power?

MR. VAN BLARCOM: Reduced to the terms of indicated horse power: We can get about 22 lbs. per brake horse power non-condensing. If you allow a mechanical efficiency of 90 or 92 that would be 20.2 pounds per indicated horse power. A non-condensing engine that will do better than 20.2 is a pretty good engine.

MR. CHAS. A. LINDSTROM: Isn't it a fact that a good deal of the efficiency of the turbine is due to the absence of friction which is a part of the reciprocating engine?

MR. L. A. PHILLIPS: Yes; due to the absence of heavy reciprocating parts and also to the extent of utilizing the high vacuum, which assists the turbine materially.

MR. O. E. ANDERSON: Suppose you start with 100 pounds boiler pressure applied to the reciprocating engine and then apply it to the turbine engine and what would be the proportionate result, the proportionate increase in favor of the turbine?

MR. VAN BLARCOM: To make that comparison you would have to state definitely the type of reciprocating engine. On a high grade Corliss engine you can get very close to the economy of a turbine, in fact you might equal it. But the average turbine will run anywhere from 10% to 25% better than the average reciprocating engine. In fact, in some engines, particularly those large triple expansion pumping engines, you can't beat them with the turbine. But the average condensing engine you meet in power houses does not come up to turbines in economy. One of the essential features to be considered in that comparison is this, that the turbine and the Corliss engine have exactly the same efficiency at their rated capacity. But the economy curve of the turbine is so much flatter than that of the Corliss engine that your station economy would be much better. For instance, suppose you had a Corliss engine and a turbine that gave you the same consumption of water at full load. At half load there is a big difference between the two in favor of the turbine; and also in overload, particularly, the Corliss curve goes up quite rapidly after you pass its efficient load, whereas the turbine curve rises slightly and then continues almost hori-

zonally. The station economy of the two systems, if they have the same rated capacity, is quite appreciably in favor of the turbine. We find that in stations where there are a number of reciprocating units and turbines the governors are generally arranged so that the turbines will take up the fluctuations of the load. The operators will give a uniform load to the reciprocating engines and let the turbines carry the fluctuations, because they are of so very much better efficiency under the fluctuating conditions.

MR. LINDSTROM: Isn't it also a fact that the turbine gains there by not having back pressure that the reciprocating engine has?

MR. VAN BLARCOM: The back pressure is very much less. In the reciprocating engine you have back pressure equal to 26" of vacuum, whereas in the turbine you run as high as 29". We have more than one turbine plant where they have 29" vacuum.

MR. CHAS. A. LINDSTROM: I mean at the end of the stroke.

MR. VAN BLARCOM: Yes; I understand that. The reciprocating engine works against a pressure equal to 26" of vacuum, while the turbine runs up to 28 or 29 inches.

DR. J. D. MILLIGAN: I do not want to disclose my ignorance, but I would like to know what the difference is between dry saturated steam and a dry saturated condition. A dry man and a saturated man in my business are very dissimilar.

MR. VAN BLARCOM: Dry saturated steam in that diagram means that there is no superheat in the steam, neither is there any entrained moisture. Commercial dry steam contains 2% of moisture.

DR. J. D. MILLIGAN: I think that after as elaborate and thorough and scientific a paper as this, it is the duty of the Club to give a vote of thanks to Mr. Phillips for its presentation this evening.

MR. D. M. HOWE: In seconding that I would amend by adding his able assistants.

The motion as amended was duly carried.

ON MOTION Adjourned.

In Memoriam.

AUGUSTUS DOWDELL

Departed this life on February 10, 1907, leaving another vacancy in the ranks of the Veteran Supply men. With his passing goes a man whose pleasing personality and sterling qualities of manhood have made countless friends who will join this Club with their sympathy to the young family who are deprived of the wise counsel and guidance of a loving father.

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F. J. REEVE,

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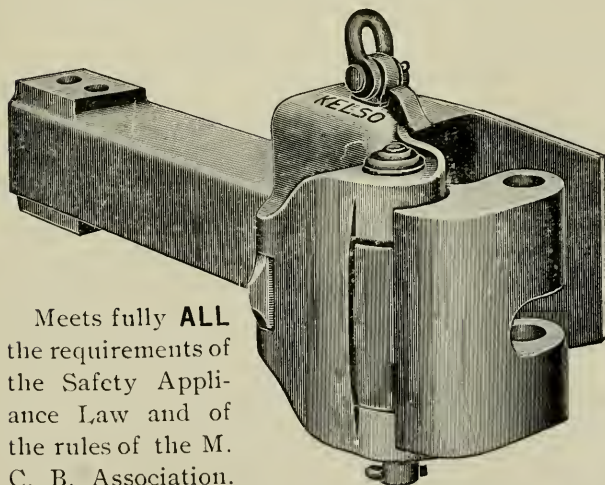
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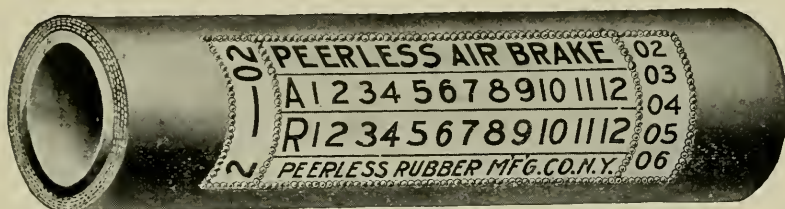
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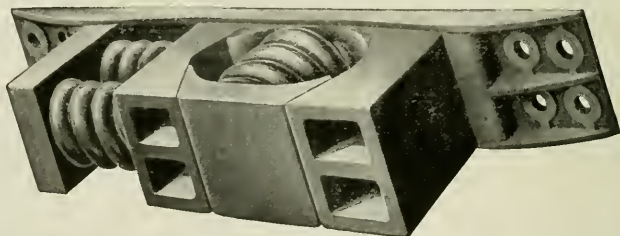
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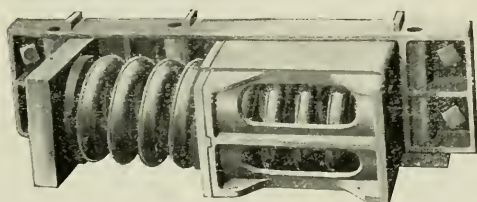
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




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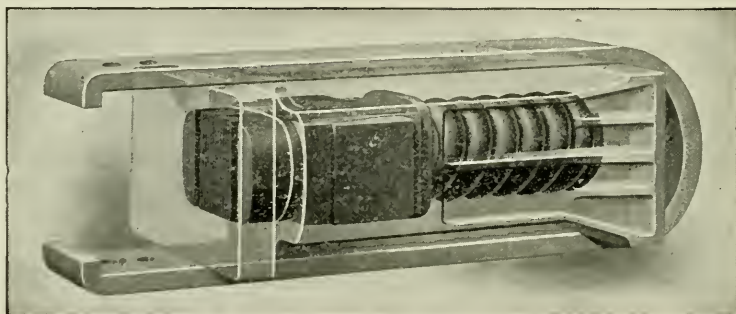
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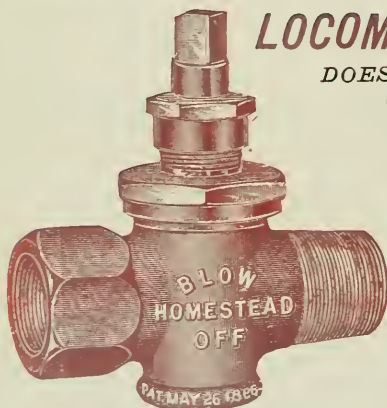
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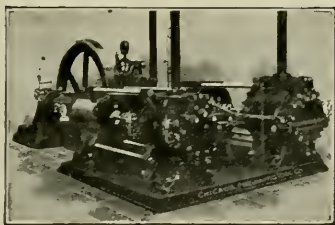
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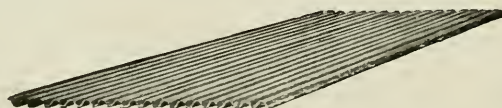
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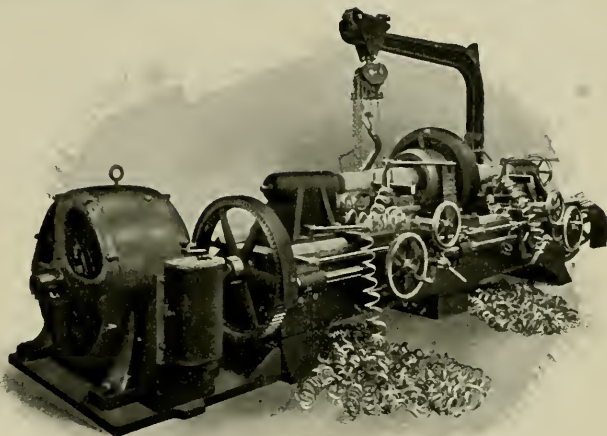
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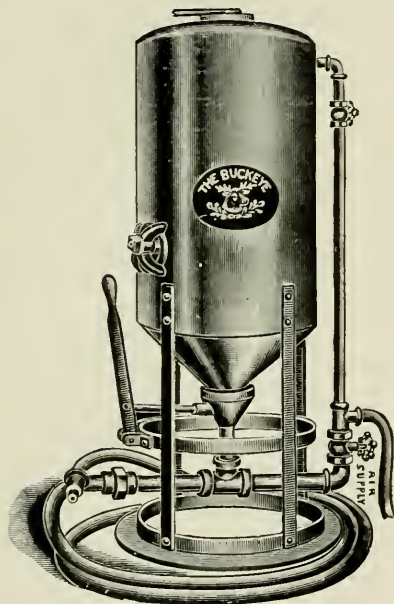
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No. 5.

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**PROCEEDINGS OF MEETING,
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The meeting was called to order at the Monongahela House, Pittsburgh, Pa., at 8 o'clock, P. M., with President F. H. Stark in the chair.

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Culbertson, O. F.	Lenhart, C. W.
Dawson, W. J., Jr.	Lindstrom, C. A.
Day, Edward B.	Lobez, P. L.
Decker, O. S.	Lynch, A. C.
Dow, G. N.	Maguire, W. E.
Drayer, U. S.	Mawhinmay, W. J.
Duckham, A. E.	Meredith, H. P.
Dunlevy, J. H.	Millar, C. W.
Dyer, Joseph.	Milliken, I. H.
Edmonds, J. F.	Mowry, Jas. G.
Foley, F. J.	Murphy, W. J.
Garrett, M. A.	McAdoo, Jno. H.
Gauss, E. E.	McFeatters, F. R.
Gearhart, J. A.	Mellwain, H. M.
George, M. E.	Mellwain, J. D.
Gies, Geo. E.	McMurray, G. W.
Grove, E. M.	McKee, F. E.

McNulty, F. M.	Soles, G. H.
Nickerson, S. N.	Spear, H. L.
Orchard, Chas.	Stark, F. H.
Patterson, W. K.	Stewart, W. W.
Peach, W. M.	Stoddart, Jas. T.
Phillips, C. J.	Street, Clement F.
Porter, H. V.	Strite, F. S.
Postlethwaite, C. E.	Stucki, A.
Prall, W. M.	Suckfield, G. A.
Prendergast, J. F.	Swartz, H. E.
Proven, John.	Sweeley, G. P.
Pulliam, O. S.	Taylor, H. G.
Quest, W. O.	Townsend, T. E.
Redding, D. J.	Trinler, Chas. M.
Richardson, W. P.	Tamkins, B. L.
Riddell, W. J.	Terry, W. A.
Ryan, W. F.	Weimer, H.
Schomberg, W. T.	Weisbrod, J. F.
Schuchman, W. R.	White, F. B.
Shannon, Chas.	Whited, Willis.
Shaw, W. F.	Whitney, Louis B.
Smith, C. G.	Wood, W. B.
Smith, R. J.	Wood, W. H.

Zelch, J. L.

VISITORS.

Abbott, J. C.	Fahsel, C. D.,
Alleman, C. W.	Fidler, Walter M.
Allen, Drew.	Foggin, Geo. T.
Anderson, O. E.	Gale, G. W.
Barth, J. W.	Hommel, H.
Bishop, J. B.	Klinger, W. J.
Bridgers, S. S.	Levi, Ernest R.
Butts, H. M.	Lichtenfels, P. H.
Christianson, A.	MacVaugh, H. W.
Craig, G. B.	Mensch, E. M.
Darnielle, S. F.	Muhlfeld, J. E.
Deakins, H. H.	McGraw, J. R.
Ellsworth, O. M.	Neison, W. J.

Orr, J. L.	Smith, J. H.
Painter, Joseph.	Snyder, F. I.
Ray, Morris J.	Speer, H. E.
Rhodes, Parry L.	Stoddart, W. G.
Robbins, J. E.	Ulrich, Henry.
Shafer, George.	Weigle, E. H.
Sheets, Harvey E.	Wiles, G. R.

The minutes of the last meeting being in the hands of the printer, the reading of them was dispensed with.

The Secretary read the following list of applications for membership:

- R. S. Armstrong, Mgr. West Disinfecting Co., 16th St. and Penn Ave., Pittsburgh, Pa.
- E. A. Craig, South Eastern Mgr., Westinghouse Air Brake Co., Wilmerding, Pa.
- J. J. Eichenberger, Freight Cashier, Penna. Company, North and Irwin Avenues, Allegheny, Pa.
- J. T. Giles, General Foreman, P. C. C. & St. L. Ry., Carnegie, Pa.
- Herbert W. MacVaugh, Mgr. The Cutter Company, Park Bldg., Pittsburgh, Pa.
- C. T. Metz, Foreman of Painters, Monongahela R. R., Box 423, Brownsville, Pa.
- W. H. Oliver, Freight Agent, Penna. Co., North and Irwin Avenues, Allegheny, Pa.
- H. Van Blarcom, Pittsburgh Mgr., Westinghouse Machine Co., Westinghouse Bldg., Pittsburgh, Pa.
- Herbert A. Wilder, Ass't. to Gen'l. Sup't., Jones & Laughlin Steel Co., Woodlawn, Pa.

PRESIDENT: Gentlemen, it gives me more than ordinary pleasure to be able to announce that we have with us tonight an eminent mechanical man who is well known throughout the United States, not only as a mechanical man but as an operating man. I will now introduce to you Mr. Muhlfeld, General Superintendent of Motive Power of the Baltimore & Ohio Railroad, who will address you.

Practical Means for Increasing the Earning Capacity of Freight Cars.

BY MR. J. E. MUHLFELD, GENERAL SUPERINTENDENT OF
MOTIVE POWER, B. & O. R. R. CO.

Mr. President, Secretary and Members:—

Having been honored by a request from the President of this Club to address you on a suitable theme for discussion, I take pleasure in referring to a question, namely—"How We May, in a Practical Manner, Increase the Earning Capacity of Freight Cars."

The great demand for increased facilities for moving industrial and agricultural products to market makes this topic of wide interest at the present time. However, before analyzing the subject in detail, it may be well to refer, in a general way, to the relations existing between the transportation companies and the public during the prevailing extraordinary financial and political situation which has been largely brought about by the unparalleled industrial activity and the enormous expansion in all branches of business.

A railroad, in the broadest sense of the word, may be termed a public highway, the officers and agents of which are dedicated to the service of the people. Its function is to transport as promptly as circumstances will permit all traffic that may be offered and to insure this result it becomes necessary to have adequate facilities and equipment, all of which must be maintained in efficient working order and used to the best possible advantage.

While a railroad company may, in accordance with the usual custom, improve its property by applying surplus earnings to betterments during a period of prosperity, still the expansion of business occasioned by the present tremendous growth of traffic has so increased the volume of freight that the needed facilities cannot be provided for out of traffic receipts, especially when the tendency of the times arbitrarily increases the cost for operation and decreases the ability to pay for the essential improvements.

The public insists upon railroads providing safe, fast and frequent service, which necessitates large outlays of new capital for right-of-way, trackage, terminal facilities, safety appliances, motive power and cars. It is, therefore, proper that with the greatest known production from fisheries, farms, forests, wells, mines, quarries, mills and factories, which has resulted in a period of general prosperity and an increase in the cost for all classes of commodities, that the transportation rates which now average the lowest for the best service in the world, should be not only maintained but increased, and that railroads should not be burdened with extraordinary expenses when their purchasing power is constantly decreasing and there is a scarcity of labor and material even at high prices.

The universal demand for greater development and utility of railroad facilities is coupled with innumerable obstacles in the way of Federal, State, municipal and even partisan legislation and repression. These oppositions, in connection with the demands for restricted hours of work, policies to reduce the scheduled tariff, increased rates of interest and fixed charges, burdensome taxation and grade separation and oppressive verdicts rendered by juries in damage and personal injury suits have all resulted in irksome conditions and in seriously hampering railroad companies in their efforts to improve the overtaxed facilities and earn a fair profit upon the invested capital.

A commonwealth is dependent upon transportation facilities for its development, and railroads that make large expenditures to render good service at a reasonable cost for the welfare and prosperity of the people who occupy the lands adjoining their tracks, are entitled to reciprocal consideration and an opportunity to expand.

The railroad administrators of great conceptive and executive ability who have been and are now most persistent and progressive in developing the resources to carry on the commercial pursuits by enlarging the means for joining the great waterways; promoting fast, through traffic movement; inaugurating telegraph, postal and express service; and establishing educational, savings, loan, medical, insurance and pension systems for the mutual benefit and protection of their employees are public benefactors who should be given every encouragement to

continue their present policies for extension, expansion and general betterment.

Carriers by railroads desire to serve the people competently and have no more intention to defy legislation or objection to publicity than other law abiding corporations. The common law is amply sufficient to insure the solution of all problems incident to a railroad company's dealings with the public without resorting to radical or extreme legislative enactment and the mistaken policy of presenting the executive officers before the people in a false light is likely to seriously depreciate the credit of these corporations. Likewise, the constant demands for a reduction of tariff rates adversely affects the standard of efficiency, thus retarding true progress and precipitating business depressions. The agitation for government ownership of railroads in this country would be short lived if those making the demands would fully acquaint themselves with the actual conditions in regard to financing, constructing, maintaining and operating railroads dominated by government control as compared to railroads under corporate control. To those informed upon this subject it seems obvious that only such legislative enactment as will insure Federal uniform supervision to preclude inequity or unjust discrimination and to render assistance in enforcing discipline would be beneficial to either the public or the railroads.

While the population as well as the development and utilization of the country's resources and of labor saving machinery has increased beyond all expectations, the facilities for transportation by rail have also made great progress and the only restrictions to further enlargement in the number and capacity of locomotives and cars are the track and bridge gauge, clearance and weight limitations, and the ability of industrial tracks and terminal facilities to receive the equipment. For example: Ten years ago industrial works received their ore, pig iron, billets and similar materials in car-load lots of 66,000 pounds, whereas with modern equipment this limit has been raised to 125,000 pounds; the limit for coal has been increased from 60,000 pounds to 110,000 pounds; for coke from 40,000 pounds to 70,000 pounds; for cotton, grain and merchandise from 66,000 pounds to 88,000 pounds, and for other items of car-load freight the limits have been relatively increased. The bulk capacity of open

cars has been enlarged from 800 to 2,000 cubic feet and of house cars from 1,700 to 2,400 cubic feet. The length, width and height of cars have been extended in proportion and the benefit to shippers and dealers in the way of increased tonnage per lineal foot of track space, reduced number of cars to handle and consequent decrease in switching charges and expense for loading and unloading freight is therefore quite apparent.

Furthermore, cars of special design and exceptional strength are now being provided to reduce the cost for dunnage to build up structural steel and other classes of unusual lading on single, double and triple cars, and the general tendency of railroads in this respect has been to increase the weight of cars in somewhat greater proportion than the capacity would necessitate, for the purpose of insuring sufficient strength in the equipment to favor the shipper by reducing the cost for loading and unloading freight and to enable the manufacturer or wholesaler to assemble a greater proportion of his output in one unit at the mill, factory or warehouse, thereby lessening the expense incident to handling and assembling this material at its destination.

Therefore, in addition to the large number of freight cars placed in service, due consideration must be given to the increase in the comparative strength and carrying capacity. For instance: Assuming that there are 10,000 tons of coal to move from the mine region to a lake port for the lading of one boat, and likewise a quantity of ore to move from the same port to the furnaces, with a given number of cars assigned to such transportation service; ten years ago to have moved this coal would have required the use of 333 cars which could have returned with 11,000 tons of ore. Today 182, or about 55% less, cars of modern design can transport the same amount of coal and return with 11,375 tons, or 3½% more ore, all of which has reduced the dock and mill yard, switching, loading and unloading facilities required by shippers and dealers to handle a given amount of business and a greater benefit has, therefore, accrued to the general public. On the other hand, the railroads, in order to handle these larger capacity cars, have found it necessary to increase the strength of roadway and bridges, enlarge tunnels, elevate overhead structures and make relatively greater and more costly expenditures for track and equipment and for main-

tenance and operation. Furthermore, as gradient and curvature is reduced the revenue mileage is also decreased, thereby giving the producer and consumer a further benefit.

In the meantime the business has outgrown the storage, loading and unloading facilities for car-load freight, and the railroads are expected to carry the burden of traffic congestion and of the extravagant use of cars for warehousing instead of for transportation purposes, whereas this expense should properly be borne by the producers, shippers, receivers and exporters. The matter of terminal facilities, and which is the limitation of handling business during times of heavy traffic, is today giving railroad managers the greatest concern and every assistance should be extended to them by the farmer, merchant, miner and manufacturer in their efforts to accelerate the transaction of business by promptly loading and unloading cars at freight origination and destination points.

Investors and all classes of business men should unite in condemning the pernicious anti-railroad sentiment, which now seems so popular, as incompatible to their own best interests. Inasmuch as the public needs constantly increasing railroad facilities, likewise the railroads need the confidence of business men and investors so that they may obtain new capital for their improvements by disposing of their securities. Thus a community of action between the producing and shipping public, wage earners, press, legislators and the railroads would do much to relieve a situation that has been brought about by commercial supremacy and a general prosperity of the country which should not be retarded.

Reverting to the question of "How we may in a practical manner increase the earning capacity of freight cars"; this can be considered under several sub-heads as follows:

CLASSIFICATION OF CARS.

The freight from which railroads secure their revenue requires the use of the following general classes of equipment, which when new built may be of the specified design and capacity:

1st—General service gondola, all-steel, 125,000 pounds capacity.

2nd—Double hopper gondola, all-steel, 125,000 pounds capacity.

3rd—Hopper, all-steel, 125,000 pounds capacity.

4th—Flat bottom gondola, composite, 125,000 pounds capacity.

5th—Flat, composite, 125,000 pounds capacity.

6th—General service, grain and coal, all-steel, 110,000 pounds capacity.

7th—Tank, all-steel, 12,000 gallons capacity.

8th—Coke, all-steel, 88,000 pounds capacity.

9th—Box, composite, 88,000 pounds capacity.

10th—Stock, composite, 66,000 pounds capacity.

11th—Refrigerator, composite, 66,000 pounds capacity.

12th—Special cars for special purposes.

DESIGN AND CONSTRUCTION.

Compact train loads increase and accelerate movement, by reducing the cost for switching and transporting traffic. Therefore, in the design and construction of a freight car it is advisable to arrange for the maximum volume and weight of lading per lineal foot of track space and for the quick loading and unloading of the greatest variety of commodities.

While convertible features should not be embodied in equipment to an extent that would result in extraordinary first or maintenance cost, a limited number of practical arrangements, such as movable floors, ends and sides may be combined to provide a car suitable to carry and dump lading such as coal, ore, dolomite, sand and similar material into manufacturing plants, and to be loaded with billets, pig iron, pipe, plate, structural steel and other commodities, thereby enabling it to carry freight both coming and going, thus reducing the light car mileage to a minimum.

Wood should be used in freight car construction only where it is required to provide for the cleating and otherwise bracing and building up of certain classes of lading and where metal would not insure the proper insulation against heat or cold.

Steel plates for horizontal flooring should be made of sufficient thickness to prevent early depreciation due to corrosion,

while inclined and vertical sheets can be made thinner, if well braced. Unnecessary joints and rivets should be eliminated and such a combination of flat and formed plates and structural shapes should be used in the construction as will provide the proper strength with the least amount of material used and enable the most economical maintenance on account of ordinary wear or tear and casualty.

Formed or cast steel sections built into the underframe as a body bolster and structural or cast steel truck bolsters and side frames can be combined to make a light and strong construction. The increasing severity of buffing and pulling stresses makes it necessary to materially strengthen the center sills by deep box designs and to distribute these shocks over a large area of the draft and center sills in a manner that will relieve all other parts of the under- and superimposed frame of the car body from stresses that will tend to loosen the rivets and joints.

Of the various items contributing to freight car delays and failures, the couplers, coupler yokes, draft gear and attachment of same to the underframes, body and truck bolsters and the wheels and brake equipment contribute either directly or indirectly to the greatest extent. A combination of coupler, coupler yoke and draft gear of sufficient strength and elasticity to withstand the locomotive maximum draw bar pull and the punishment due to buffing shocks will, when securely attached along the center line of draft to the center sills in such a manner as to distribute the stresses at the greatest number of points and over the largest area, materially reduce the coupling difficulties.

The use of substantial body and truck bolsters that will carry the ultimate load at the center plate; of anti-frictional center plates and side bearings, and of ample lateral movement for couplers at the end sills will do much to reduce train resistance, wheel flange wear and liability for derailment. However, so long as the rail section now generally in use is continued it will be difficult to prevent rapid wheel flange wear and possibility for breakage, but a refined chilled cast iron or a one-mileage forged steel wheel with hardened flange and tread wearing surfaces would be of general benefit, if produced at a reasonable cost.

The necessity for the use of hand brakes in the controlling

of freight trains on long and severe grades at speeds that will provide for the movement of the maximum business with a proper degree of safety, frequently determines the tonnage of trains both up and down grade, and a combination of air and foundation brakes, brake beam and shoe, and slack adjusting equipment that will insure maximum allowable braking power per car and place the entire control in the hands of the locomotive engineer without liability for sliding wheels, will be of material assistance in increasing the capacity of railroad lines traversing a mountainous section.

INTERCHANGEABILITY OF PARTS.

While the Master Car Builders' Association has made much progress in promulgating general practices and adopting standards of minor parts of cars, such as—wheels, axles, journal boxes and contained parts; brake beams, heads and shoes; couplers; hose; side and end doors; helical springs; foundation brake gear; safety appliances and marking—the changed conditions now make it essential that car bodies and trucks as a whole, of similar kinds and classes, shall be simplified by standard practice and made interchangeable, and it is anticipated that some final action along these lines will result from the coming meeting.

MAINTENANCE.

The freight car of today must withstand about as much grief as the average mechanical department official. It is required to operate on 60 degree commercial track curves and over any obstacle; to withstand a 25-mile per hour impact when loaded and passing through gravity and hump yards; to be mauled and turned upside-down for dumping; to receive red-hot lading, such as billets, pig iron and slag; to resist the steam, fire and dynamite that is used to loosen frozen loads of coal, sand and ore; to submit to the corrosive action of acids, alkalis, water and weather; to retain any load that can be safely gotten into or on top of it; to endure loading by crane hoist; undergo removal of lading by clam shell, scraper or plow; to be able to lose any part of itself that may facilitate loading or unloading and to still retain its identity and return to its owners with a clear record against delay, failure or personal injury.

Therefore, it becomes necessary that the maintenance of this equipment be given adequate attention to insure it against the general operating causes for failure which consist of unsuitable distribution and use of cars that are adapted for only certain classes of commodities and service; freight improperly distributed or built up; lading beyond the allowable capacity for distributed or concentrated weight; abuse by consignors and consignees when loading and unloading; cars of light capacity and design placed at the head end of and between cars of heavier types in trains; and rough handling by yard, train and engine crews.

The number of loaded and empty system and foreign revenue freight cars, (exclusive of cars in bad order condition under load at destination), held over each day, (except after Sundays and legal holidays), for all classes of accident and ordinary repairs, should not exceed 3% of the total system and foreign revenue cars on the line and the repair force and material should be so regulated that no more bad order cars will be detained each day than the number repaired, every preference being given to loaded and empty cars that are in the greatest demand for the movement of the business offered.

When the earning capacity averages from \$2.50 to \$3.00 per day for each freight car available for service, the interest on an investment for shop facilities to adequately economize and increase the output can be readily justified. Such facilities should provide shelter from sun, rain, snow and wind for workmen employed on cars requiring heavy repairs, so that the usual increase in the proportion of bad order cars after unfavorable weather conditions will not be so marked as at present. Ample and up-to-date metal and wood working machine tools, pneumatically or electrically operated portable and hand tools and general facilities for the storage and portage of all new, second-hand and scrap material are most essential. Transfer trestles and cranes should also be installed in freight car repair yards to reduce switching, delay and expense for transferring and rebuilding lading on cars which are not in condition for movement.

Indifferent foreign cars should be put in proper repair for loading and not returned to the owners light except when generally worn out by age and decay, or unless lading is not avail-

able and a home station is close by. This practice will avoid loss due to light mileage and additional damage to the car through its movement in a defective condition.

The prompt and proper switching of cars on repair tracks is an operation that is frequently overlooked and which is usually given indifferent attention and is done at whatever time the yard switching service may find it convenient, rather than during a period when it will least interfere with the working of the forces. Many unnecessary and costly movements can be avoided by the spacing of cars when they are switched on the shop tracks so as to eliminate the delay and expense that would otherwise occur by jacking the cars apart and moving them by hand.

Certain classes of cars should be given special repair attention at those seasons of the year when the business least requires their use or when the repair forces can be worked to good advantage during daylight and favorable weather. System cars of a class and capacity which makes them desirable for five or more years' service, should, when empty and placed on shop tracks for heavy repairs, receive such renewals and betterments as will put them in a substantial condition. The repetition of classified repairs which do not permanently improve such equipment results in temporary maintenance, successive line failures and delays to traffic, and continued expense for the same class of work. Good material removed from cars that should receive heavy repairs and betterments to put them in efficient condition, can always be utilized to advantage when making lighter classes of repairs to loaded and empty cars to keep them temporarily serviceable until they can be properly reinforced.

TERMINAL AND INTERCHANGE INSPECTION.

The object of the Master Car Builders' Rules is to facilitate the movement of cars in interchange service and to place the responsibility for defects which may or may not make a loaded or empty car unfit for service. However, the intent of the rules is frequently nullified through a lack of good judgment owing to the somewhat general impression that the ability of a Car Inspector is decided by his record as a "car stopper" rather than as a "car mover," and the holding of cars by unintelligent inspection or on technicalities at joint and interchange points, is

responsible for much delay to traffic, expense for transferring lading and loss of use of equipment.

Cars set off on the line of road due to bad order condition of couplers, draft attachments, wheels or brakes; heated bearings; shifted lading and other similar causes are usually the outcome of improper inspection, repairs, adjustment or testing of brakes, lubrication and loading at originating terminals, and result in accidents, destroyed lading and cars, reduced train rating, delays to traffic, blocking of passing sidings, engine and train crew overtime and extraordinary expense for sending men and material out on the line to make repairs. The elimination of rules and inspection points which are unnecessary to maintain cars en route in a serviceable condition for operation and safe for trainmen and lading; fewer and more thoroughly trained car inspectors; agreements between connecting lines that will keep cars moving on such interchange records as will insure proper accounting for repair charges; a greater number of more competent car repairmen and more thorough attention given to equipment at the unloading and loading points will, without a doubt, reduce some of the present line delays.

The substantial building up and proper distribution of freight on single, twin and triple cars by shippers is also a detail that will do much to reduce delays to their freight between origination and destination points by eliminating the necessity for rebuilding and transferring lading or for setting out cars en route for consequential repairs due to derailments, heated bearings and similar causes.

LOADING AND UNLOADING.

In general, shippers and dealers have been greatly benefited by cars of increased cubical and weight capacity per lineal foot of track space; by improved designs requiring the least expense for loading, building up of lading and unloading; by greater tonnage per car requiring less cars to be switched and by reduced terminal car mileage, while the railroads have not derived a proportionate increase in revenue to make up for the increased initial and operating cost, due to the sluggish movement of tonnage at terminals; reduced proportion of paying to

dead load and an increased expense on account of rougher handling, and greater depreciation due to wear and tear.

During the transition from the light to the heavy capacity cars, more especially in connection with the higher class and more expensive equipment, the minimum weight limits for car-load rate lading, which should be such as will insure full loading of the car, have remained stationary and this has made it difficult for railroads to demonstrate the advantages of the more modern service provided due to the increase in the paying load per car not having kept pace with the proportionately greater capacity and weight per car. The longer time taken for loading and unloading has also contributed materially to the inability of railroads to derive from their enlarged and improved trackage, terminal yard, motive power and operating facilities the movement of revenue freight that their investment has provided.

While cars are intended for the legitimate purpose of transportation, they do everything but spend the majority of their time in moving freight and the existing situation should be remedied by restricting the free time allowance for loading and unloading car-load freight to the real necessity of shippers and receivers who have provided adequate track and storage facilities to handle their business, and who do not require that the railroad terminal yards and equipment shall be incapacitated through their failure to handle lading on and off cars promptly.

Railroads should not be required to provide equipment to meet extraordinary transportation demands when sluggish handling, for which they are not responsible, exists at terminals, but it is proper that they should apportion the car supply on the basis of the time required to load and unload, and to refuse to furnish cars at regular rates to those who have no handling or storage facilities and who make extravagant use of railroad company's equipment and tracks from which to handle business purchased by them in car-load lots.

With the present earning capacity of freight cars the collection of the demurrage or rental charge in excess of the free time allowed, reimburses railroads to only a slight extent for the revenue that could be derived if the equipment was available for its legitimate purpose instead of serving time and increas-

ing the expenses by a greater physical and obsolescent depreciation and interest on the investment than would be the case if it was employed in transportation.

The railroad demurrage rules and rates should be brought more nearly to a basis commensurate with warehouse storage so that the value of their equipment, tracks and terminal space will have similar earning capacity. While legislation exists permitting railroads to impose demurrage charges for delays in unloading there is none to compel the consignees to unload cars, although a decided reduction in the free time and other concessions allowed shippers whose business has outgrown their warehouses, elevator and other storage facilities would not be unreasonable.

A commercial or industrial organization would not think of allowing the equipment upon which it is dependent for its output to lie dormant for 21 hours during each 24 hour period, but this is the freight car situation of railroads which are today being criticised for the non-movement of important traffic. Under these conditions the consignors and consignees directly concerned are the only persons benefitted, and instead of a shortage of car supply there exists a shortage of car movement which can only be relieved and improved by the utmost combined individual and collective work on the part of the shippers, dealers and railroads.

To insure the prompt handling of the traffic of those consignors and consignees who have provided suitable and adequate facilities for forwarding, receiving and storing freight, it is but proper that such rules should be promulgated as will give them the same proportionate benefit of the improved railroad facilities that their own progress and investment justifies. This might be satisfactorily accomplished by increasing the present extremely low tariff rates and allowing a commutation on the total freight charges in lieu of a proportionate reduction in the maximum free time allowance for loading and unloading equipment after consignors or consignees have been notified that the cars are subject to their disposition. By this means a premium in addition to the established demurrage charges would be exacted from those dilatory shippers and dealers who do not co-

operate with each other or with the railroads to reduce the idle time of cars, and the public would be materially benefitted by the enlarged transportation facilities that such a rule would bring about through efforts on the part of delinquents who would, of necessity, have to relieve equipment so that their freight charges would be on a comparative basis with those of the more progressive concerns.

Industrial and railroad companies should co-operate in providing right-of-way and tracks to improve terminal facilities that will enable the former to take care of their average daily in- and out-bound business with the least switching and delay of cars so that the increased railroad terminal trackage will not be appropriated for the storage of cars for loading or unloading that should be placed on tracks not under their control.

DISTRIBUTION AND MOVEMENT.

The free interchange of equipment facilitates the movement of traffic, enhances the value of commodities and extends the markets, and the direction that a car should take will be influenced more by the business offered than by specified rules and regulations. It is manifest that the per diem rules governing settlement for the use of freight cars has stimulated activity of a switching and empty car rather than of a loaded car movement, and that the scarcity of foreign and system cars for the handling of railroad business is a question of common interest that is causing embarrassment to the carriers and annoyance to the public.

A basis for the interchange of equipment which will insure to each contributor its proportion of class and carrying capacity and eliminate unnecessary light mileage, is decidedly lacking and as an average of about 90% of the freight cars on a railroad will be found standing still at any moment of the day, with a resulting loss of track, motive power and terminal yard capacity to handle the business, there is the apparent necessity for the same rules and supervision to facilitate the movement of individual cars, when at connecting points and terminals, as is provided for trains when they are on the line of road.

If a car could be moved in the direction of maximum lading and kept moving, preferably on its owners', but if necessary on foreign lines, it would then obtain its greatest commercial value and the present general average of about one mile per car per hour would be greatly increased and the percentage of switching and empty locomotive and car mileage substantially reduced. With such a system much of the present congestion could be removed, and by efficient method in the distribution, interchange, inspection, repairs and movement of available equipment, the necessity for expansion of trackage and multiplication of motive power and rolling stock would become less prominent.

While greater earnings per car mile reflect increased lading and capacity per car, such benefit may be more than offset by reduced earnings per car per day on account of less miles moved, and the car mile hour basis becomes the real factor in computing its revenue value. Therefore, to accomplish better results for shippers, receivers and owners in the distribution and movement of cars, a combination of greater lading and quicker handling is necessary and some of the following rules may be worthy of consideration:

1st—The distribution of the year's business and regulation of the movement of the general commodities required for living purposes to conform to the periods of greatest supply and demand and to the capacity of the railroads to handle the same, preferably during the season that gives the combined maximum speed and train load.

2nd—The distribution of cars as between shippers on the basis of their capacity for output and ability to promptly load and secure disposition of lading and release of equipment at destination.

3rd—A restricted supply of equipment to shippers and dealers who practice obsolete business methods and load and hold lading in cars subject to future market conditions.

4th—The distribution of cars, as between railroads, on the basis of the number, cubical and carrying capacity of cars of the different classes owned; on the routing of the lading and on the mileage of the originating and non-originating traffic over the various lines.

5th—Cars of such general condition that they cannot be depended upon to promptly pass inspection at interchange points should be restricted to owners' lines where company's material, local freight or other suitable lading can be hauled with the least liability of delay, transfer or repairs.

6th—An increase in the car-load minima commensurate to the enlargement in the equipment and the confining of classes and capacities of cars most suitable for local shipments to the territory where they will average the greatest amount of lading per car-load lot.

7th—The use of cars for such commodities as will permit of maximum lading, quick loading and unloading and non-interference with the use of the equipment for its designated purpose.

8th—The non-use of railroad revenue service cars for the handling of mill refuse, garbage and like materials.

9th—A public storage for bulk freight that cannot be promptly disposed of or trans-shipped at lake and tidewater ports; a reduced and uniform free time allowance for all commodities and an increased demurrage charge for cars placed on railroad and industrial tracks for loading and unloading.

10th—The billing of lading in car-load lots from origination to final destination and the discontinuance of costly stop-over privileges for sampling, transferring or milling grain, dressing lumber, compressing cotton and like manipulation involving re-billing at intermediate points.

11th—A curtailment of the re-consigning and re-adjusting privilege and an increase in the charge.

12th—To stimulate the making of quick repairs, bad order cars to be no exception to rules covering servicable cars, except where unsafe to load on account of general worn out condition due to age or decay.

13th—System cars consigned to company's use business to be placed under car service charges.

14th—A system of tracing for the location of delayed shipments in cars standing on siding, yard, repair and storage tracks, for the purpose of facilitating the movement.

15th—The classification of trains to increase the main line movement of cars through or around the greatest possible num-

ber of intermediate terminals and to reduce the switching movement.

16th—The non-holding of motive power for maximum train loads to be moved against the flow of traffic.

17th—The prompt and regular movement of freight from loading to unloading points and advance information as to movement and arrival to be given the consignee.

18th—The running of trains after regular intervals and with respect to the destination of cars rather than from one divisional terminal to another.

19th—Reduced delays to trains at origination and destination terminals and en route, and the maintenance of a uniform schedule speed equivalent to at least 75% of the average running speed.

20th—Locomotives suitable for the handling of trains of the greatest permissible tonnage at the maximum allowable speed over the different operating divisions should be used and loaded with a reasonable remaining surplus of power to prevent liability of trains failing to make schedule time. Locomotives of great power have too often failed to meet the requirements on account of being attached to trains of greater resistance, as practical experience has now demonstrated that steam locomotives of 70,000 pounds tractive power can be as satisfactorily maintained and operated for hauling freight trains as those of one-half the capacity.

(a)—Speed and grade are factors that largely control the loading of locomotives as well as the cost for their operation. Running speeds of 15, 20 and 25 miles per hour are more economical than speeds of 10, 30 and 35 miles per hour. In general freight locomotives handling low class tonnage should be loaded to haul trains at an average schedule speed between terminals, including road delays, of from 12 to 15 miles per hour, on low grade, and of from 10 to 12 miles per hour on high grade lines, which is as fast as economy will allow. This will require a running speed of 20 miles per hour over a division, except on the ruling grade where they should be loaded to maintain a running speed of 8 miles per hour, unless the grade is over 2 miles in length, when they should be loaded to maintain a running speed of from 10 to 12 miles per hour. On a fairly level divi-

sion, with considerable curvature, it may be necessary to reduce the loading on the ruling grade in order to maintain 20 miles per hour over the other portions of the division, and in which case the rating of the locomotive for 20 miles per hour is the ruling factor. In rating locomotives the tonnage determined upon should be such as will give the same resistance behind the tender and which is not necessarily the same dead weight.

(b)—The hauling capacity behind the tender of a simple cylinder freight locomotive, having a ratio of not less than 4 between tractive power and weight on drivers, and operating on straight, level track at a speed of 8 miles per hour may be represented by the following formula:

$$H = \frac{.8 \text{ } p d^2 \text{ } s}{D} - 10 W \quad \text{in which}$$

H = maximum hauling capacity in pounds at rear of tender at a speed of 8 miles per hour,

d = diameter of cylinder in inches,

S = stroke of piston in feet,

p = indicated boiler pressure in pounds,

D = diameter of driver wheels in feet,

W = weight in tons of engine and tender in working order, including full load of coal and water.

10 = rolling resistance per ton of locomotive in pounds at 8 miles per hour.

From the maximum hauling capacity so derived the available hauling capacity, at any desired speed above 8 miles per hour that will give between 250 and 650 feet of piston speed per minute, can be determined by the following formula:

$$A = H (1 - .001 (P - 250)) \quad \text{in which}$$

$$P = 56.022 \left(\frac{R S}{D} \right) \quad \text{in which,}$$

H = maximum hauling capacity, in pounds, at rear of tender at a speed of 8 miles per hour;

D = diameter of driver wheels, in feet;

S = stroke of piston, in feet;

R = desired running speed, in miles per hour;

P = piston speed, in feet per minute;

A = available hauling capacity of locomotive, in pounds, behind tender at desired speed.

From the available hauling capacity so derived must be deducted a resistance of 2 pounds per ton for each .1% of grade and 2 pounds per ton for each degree of curvature not compensated, using this adjustment for the combination of grade and curvature that produces the maximum resistance on the division over which the locomotive is to be operated, after which the rating may be calculated as follows:

(c)—On a straight, level division, at a running speed of 10 miles per hour, a loaded 100,000 pounds capacity car has a resistance of about 5 pounds and a loaded 60,000 pounds capacity car of about 6 pounds per ton. When empty both cars have a resistance of about 9 pounds per ton. For each 5 miles per hour increase in running speed up to and including 20 miles per hour, 1 pound per ton; for each .1% of ruling grade, 2 pounds per ton, and for each degree of ruling curvature not compensated .7 pound per ton should be added for additional resistance. The adjustment for gradient and curvature should be for such combination as produces the maximum resistance on the division over which the train is to be operated and curves on grades compensated at a minimum of .035% per degree of curvature can be disregarded.

To allow for the difference in the resistance of empty, partially loaded or loaded cars, the following adjustment figures, which represent the difference in tonnage divided by the difference in number of cars as between the loading for loaded and empty car trains, should be added to the weight of each car:

Minimum grade.....	15 tons per car			
.3%	"11	"	" "
.5%	" 8	"	" "
.75%	" 6	"	" "
1.00%	" 4	"	" "
1.50%	" 3	"	" "
2.00%	" 3	"	" "
2.50%	" 2	"	" "

(d)—Different ratings should be provided for the following temperature conditions:

The maximum rating for above 45 degrees Fahrenheit,

The next rating for above 35 up to and including 45 de-

degrees Fahrenheit. (Add 1 pound per ton to resistance of loaded and empty cars for rating above 45 degrees Fahrenheit.)

The next rating for above 20 up to and including 35 degrees Fahrenheit. (Add 2 pounds per ton to resistance of loaded and 3 pounds per ton to resistance of empty cars for rating above 45 degrees Fahrenheit.)

The minimum rating for 20 degrees Fahrenheit or below. (Add 4 pounds per ton to resistance of loaded and 6 pounds per ton to resistance of empty cars for rating above 45 degrees Fahrenheit.)

With heavy snow or wind, bad rail or locomotives in indifferent condition, special allowance must be made to meet the conditions.

Care should be exercised when the temperature is below 45 degrees Fahrenheit and varies during a 24-hour period that the highest permissible rating is used for runs which occupy the time of day when the most favorable temperature, rail and weather conditions may exist.

In making up trains the loaded and heaviest capacity cars should be placed ahead and house car doors should be closed and locked.

(e)—When a helper locomotive is used on a train as a double-header, 90% of the combined ratings for the locomotives should be used. When a helper locomotive is used as a pusher the combined ratings for the locomotives should be used.

(f)—Special rules must be made for special cases, as the combination of speed and load that may give the best result will depend largely upon the density and kind of traffic, length of run, operating limit for length of train, ruling and momentum gradient and curvature, reverse curves, elevation of curves, condition of rail and roadbed, main and passing trackage, water and fuel stations, slow orders, stops, fuel and locomotives.

21st—A railroad operating on a tariff basis should secure interchange freight car service, dependent upon its rules governing traffic, transportation, condition of and repairs to cars and loading of material, and be responsible to the car owner as follows:

(a)—Loaded and empty system or loaded foreign cars to be accepted at any junction or terminal point on its system, but the right to accept or reject empty foreign cars is reserved.

(b)—The return of its own cars or of an equivalent in class and carrying capacity of foreign cars to be demanded from the receiving railroad to which it may have delivered its own cars under load, 30 days from date of delivery and after having given 10 days' notice. The return of its own cars to be demanded from the receiving railroad to which it may have delivered its own cars empty, 60 days from date of delivery and after having given 20 days' notice. This rule is subject to Section (h).

(c)—A car will be equivalent to actual cubical contents in feet, times marked carrying capacity in tons, divided by one thousand, equals 100 for house cars, and to actual cubical contents in feet, times marked carrying capacity in tons, divided by one thousand, equals 50 for open cars. Flat, tank and refrigerator cars will be subject to Section (h).

(d)—Car service value to be \$0.75 per car per calendar day.

(e)—Car service value to be \$1.50 per car per calendar day for cars not returned as per Section (b).

(f)—In the case of cars loaded with specified traffic at the time of notice of an embargo, the delivering railroad to reclaim car service value for all cars not accepted by the receiving railroad during the embargo.

(g)—Local rules to apply after cars have been destroyed and reported as per Master Car Builders' code, as well as to switching and industrial lines, owning or not owning freight cars, who may receive cars on their tracks from railroads.

(h)—Special and private cars to be subject to special rules.

DISMANTLING.

For the benefit of connecting railroads handling either interstate or intrastate traffic it is essential when a freight car of undesirable class and capacity has outlived its usefulness and reaches a shop track in such bad order due to age, decay and corrosion that the expenditures necessary to put it in serviceable condition is not justified, that it should be disposed of by dismantling rather than by sale, to insure its identity being absolutely destroyed.

Each car to be disposed of should be properly passed upon at the time that it condemns itself, rather than as a part of a general dismantling program at some predetermined period.

There is always some good material in a wooden freight car body, such as lumber, rods, bars, castings, bolts and nuts which can be utilized to advantage in repairing other cars, and the trucks, either wholly or in part, can invariably be disposed of by use under other equipment. Therefore, the destroying of cars by burning is only warranted in cases of extreme damage by accident on the line of road.

MATERIAL AND COMMERCIAL VALUE.

Each car when originally constructed carries with it a commercial value that is subject to such annual depreciation as its physical condition and earning capacity may justify.

While the repairing of equipment at regular intervals during a certain period will maintain its utility to perform the service for which it is intended, the physical depreciation on account of fatigue, corrosion and decay of materials, refitting of parts and wear and tear due to fair and unfair usage, finally results in a condition where the increasing cost for maintenance will not justify further expenditures. It then becomes a matter of judgment as to whether the car should be maintained for commercial or company's use by a reduced class of service or capacity or both, or dismantled and replaced by more modern equipment having such comparative earning capacity and cost for maintenance as will overbalance the greatest interest on the investment and the charge for putting the unsuitable car out of service.

The combined material and commercial utility of a car must, therefore, be considered when making replacements and equipment in the stock should be subject to such annual depreciation adjustments, based on the inventory and salvage valuations, as will insure its proper capitalization.

I thank you very much for your courteous attention and trust that the criticism and discussion that this paper may bring out will stimulate a general and cordial co-operation to accomplish better results for the shipping public and the stockholders of the railroads.

PRESIDENT: The speaker has covered the subject in a very broad and logical manner. The successful solution of the problems that confront railway managers is not an easy matter, and a free and impartial discussion of this paper, both from a mechanical standpoint and a transportation standpoint, will serve to enlighten those that are most directly interested and also create a more intelligent and conservative sentiment on the part of the public. This Club has the reputation of taking up the subjects presented in a very active manner, and I trust this occasion will not be an exception to the rule. I would like to ask Mr. Prall, Commissioner of the Pittsburgh Car Service Association, to open the discussion.

MR. W. M. PRALL: Gentlemen: This is rather a mechanical than an operating question. Still there are certain matters that have been touched upon that come very near to the obligations that I am trying to fulfill for the railroads and for the public. I notice, in the beginning, that it is thoroughly well recognized that a railroad is a highway, and the highway must be used to the advantage of the community, the entire body politic. But it cannot be controlled by more than one operating company at a time. The difficulties of transportation make it necessary that every move made by a railroad must be supervised. I do not say that we have intelligent supervision, but we are all trying to attain to intelligent supervision. In solving the problems it has to be remembered that a house divided against itself will fall, and it is in the interest of the operating company and its patrons first that we should attain to some understanding by which we can pull together. I think some of the gentlemen will recognize that expression. I am always pleading that we should pull together. And we never will pull together until we have an understanding of the mutual benefits to all of us by so doing.

On page six reference is made to the fact that business has outgrown the storage, loading and unloading facilities for carload freight. There is no question about that. We have been endeavoring for a number of years by multiplying the service to supplement the deficiencies of many of the consignees. There are consignees who fully understand that in their own interest it pays them to reduce the cost per ton for handling

their freight. There are other consignees that think that if the railroads will supplement their disabilities there is a reduction of actual expense to them in the operation of their business. That is not the fact. The transportation expense is now paid for and it must continue to be paid for in the rate. There is no escape from the fact that you cannot take something from nothing. And the transportation question is today a trade question, a commercial question, and it has to be solved on commercial lines. Therefore there must be an understanding of just what the mutual responsibilities are.

With reference to the fact, which I think was rather under-than over-stated, that a car is standing idle 21 out of the 24 hours, it is evident that there is something to be corrected. We certainly should attain to something better than a movement of 3 hours out of 24, the rest being taken up in classification of freights by the railroads themselves, in loading and unloading, and in redelivery of cars to railroads for service, etc. I want to say that "the pot cannot call the kettle black." The interchanges between railroads and industrial lines and the interchanges between railroads and other railroads are on a parallel. You will find railroads today interchanging a great amount of freight on interchange tracks of extremely limited capacity, receiving and delivering on the same tracks. A car takes up just so much room on any track, and a railroad that fails in arranging for adequate interchange tracks, magnifies its switching service, in many cases has to perform double service, making two or more switches when one would have accomplished the service.

It is the same in interchange with industries which do their own switching, and it is worse with the industries where the railroads do the switching. Consignees are everlastingly demanding that they should be put in such position that while the number of cars required in their business is 10, 20, 30 or 40 cars per day, that the railroads should operate a siding having a capacity for 5, 6 or 7 cars. To insure their services it is necessary that they should make proper arrangements for the receipt of their business, avoiding the nuisance and expense they go to in tracing the cars, that a railroad not having a place for, throws into their hold yards. It is absolutely necessary as one of the factors in the solution of the service problem that there

should be a daily report of every car detained in any yard over 24 hours, to be followed by a second to a superior officer of every car detained over 48 hours, to be followed by a third report to his superior officer of every car detained 72 hours.

In regard to the interchangeability of parts. I have always been in accord with the Master Car Builders, who have insisted that there should be interchangeable parts worked down to a minimum number of standards. I do not believe any Master Car Builder today would say that you could have one standard, but we should work down to a minimum number. That is another difficulty to solve, because we are all prone to believe that we have a little better knowledge of the details of our own business than anybody else; and a Master Car Builder when his company has decided to build, is very prone to change the standard very slightly, just enough to give individuality to his cars. The Master Car Builders today think that there is an absolute necessity for interchangeability of parts, because if the parts are not in stock they have to be ordered and the car has got to stand until the stock is furnished. The situation is so bad that in the per diem agreement the charge is waived from the date of the ordering of the material for repairs until that material is delivered to the line in whose possession the bad order car is.

Shipping Facilities—I believe we will all agree that we ought to get \$1 worth of work for \$1, and I believe we all know that in the stand the railroad has taken in the past they took care to do the repairs at a time when they got from 50c to 60c on the dollar. They did not take advantage of slack business to keep their cars in repair. It is only necessary to refer to the Illinois Central in regard to their locomotives. During the slack period every engine was run into the shop and put in absolute repair and greased, and when they wanted it they had it. And that brings me to the point I have so often maintained, that no matter what the capacity of the main line may be, no matter what the capacity of the interchanges may be, no matter what the organization or how efficient it may be, or how many cars you have or what the business is, the railroad does not earn a dollar of revenue if it does not have a locomotive to pull the car. The cheapest insurance a railroad

can have for its business is a surplus of motive power. When you come to consider fixed charges on investment account, you will find that the smallest premium on which to insure the business of a railroad is its investment in motive power.

I think I have fully covered in my remarks my honest belief in regard to sluggish movements. Without organization you will have sluggish movement. In relation to the question of increased revenue with an allowance for prompt unloading of the car, if this means a premium in addition to the established demurrage charges to be exacted from such shippers and dealers as do not co-operate with each other and with the railroads to reduce the idle time of cars, to my mind that is the only possible, as a mathematical demonstration. When you come up against the actual business of the country you will find that you cannot afford to offer a premium without you accept a penalty, and we are not in a position at the present time to clear the public and ourselves on the basis of premiums and penalties. No matter if a law is passed, the law is just as strong as the people who are behind it, and a law that is not maintained by public sentiment becomes a dead letter. This is a democracy, so-called, and we do have some of the underlying democratic principles. We do claim that we govern ourselves, and think it, too; but possibly we do govern ourselves very well. I think we have an elegant exhibition at the present time of the ecstatic condition of a certain portion of the community, small in number but loud in voice, with pens dipped in venom, who fail in understanding that they are attacking their own problems, and that it is their interest to give due and adequate consideration to every factor in the problem. It is well said that the present situation is unique in the history of modern times, in that we are all suffering from a magnificent extension of our business. The railroads are absolutely unable to handle the business that is offered; they are absolutely desirous of handling every ton of freight that any consignee could require them to handle, and the only reason they do not handle it is because they cannot. I do not believe there is a railroad man in this room, if he has any gray matter, that has not lost sleep in the last two years trying to uniform car movement.

In regard to the statement that industrial and railroad com-

panies should co-operate to provide right of way and tracks to improve terminal facilities that will enable the firm to take care of their average daily in and out business.—I heartily indorse that, and a reasonable way should be kept clear for all interchanges, kept clear by the owner of the siding and by the railroad after the owner, as he many times does, and has actually fulfilled every obligation which he is properly called upon to fulfill. Every siding is handled in a different manner from every other siding. Each one is a problem in itself, and when the problem is finally solved each party can and will come to a mutual agreement as to their reasonable responsibility.

That brings me to the various propositions. There is a great deal proposed that is good. Some, however, would be unlawful. For instance No. 3. Under the Hepburn Rate Law we are not allowed to consider actual conditions. It don't make any difference what conditions may be engendered by a shipper who does not propose to unload his cars when they arrive at destination, you have got to furnish him cars. The shipper who does make proper arrangements has to suffer. Which may be a good law but is mighty poor practice.

The 5th. I have had a little trouble when I have come up against joint car inspectors. Mr. Muhlfeld put it very concisely when he stated that some of them were car stoppers instead of car movers. To me it is an absolute absurdity when a car can go to place and could be handled to place and the railroad would be protected by the card, that the car cannot be moved. That car has to be returned and put through the neck of the bottle. All interchanges are the neck of the bottle, and it don't make any difference how big the bottle is, the water all has to go through the neck. If you force a car to go through three or four times unnecessarily there is some other car that will not get through, and that delays movement of all the others.

No. 6. I have often wondered why the traffic department did not increase their minimum in proportion to the increased capacity of the car. I have thought that possibly it was because of the opposition of a good many of the present contesting shippers in the central portion of the country who object

to buying any more tons or thousands of pounds of any given freight today than they did, although the lading must be handled by the railroads in a car that is double the cost of the old car.

No. 9. Public storage. That is one of the problems looming before the community today, being taken up by the Car Hire Committee, the Per-Diem Association and various other committees to the end of some solution. The question has been, who shall stand the expense? Thousands of cars have been held at seaboard awaiting the convenience of the vessel owner, who has never failed to allow the cars to remain there after the contract day has arrived if he can get a shilling a ton more freight from a competitor. Those cars are standing there at the expense of the industrial and agricultural community in this country. It is never absorbed in the price, because the price is dependent upon the market and in accordance with values in foreign countries. Consequently the exporter is forced to handle his business on the basis of the price *in the foreign market*, and if the railroads hold cars at seaboard for the convenience of vessel owners they are practically adding to the expense of operation, which must be shown in the rate and absorbed. That is a good word, we use it so often; absorbed in the expense of conducting operations.

No. 10. I think the general auditors have been wrestling with that proposition for 20 years to my knowledge. There is no reason why it should not be done excepting prejudice. Some one is afraid that someone else might in some way obtain some advantage.

No. 11. There is no question about that necessity. It is a known fact that three years ago cars have been reconsigned and again reconsigned and then reconsigned and finally moved forward to seaboard for the last market, coming from trans-continental terminals and billed to Kansas City or St. Louis, then to Chicago or Cincinnati, then to Pittsburg, Cleveland or Buffalo for a market, and if they are not sold at the interior points they are reconsigned to the seaboard. The shipper had not sold his lading before forwarding and the billing was not bona fide.

PRESIDENT: We have representatives here—as might be illustrated by one of the sayings of Andrew Carnegie re-

ferring to the old three legged stool, neither is first, neither is last, and each is dependent on the other. So we have here representatives of the manufacturers, the railroads and the consignees. We would like to hear from Mr. Bihler, representing the manufacturers.

MR. L. C. BIHLER: There is so much good material in what Mr. Muhlfeld has said that there is very little to criticize. But there are a few points on which I will take time to make a few brief remarks.

Page 7, Classification of Cars: Mr. Muhlfeld places the capacity of cars at 125,000 lbs., which I think is all right. But I want to say that the steel wheel ought to go with it. The Master Car Builders have improved every part of the car, but the poor wheel has not got its just deserts. There are several interests at work on it now, and when you get steel wheels under your 125,000 lb. cars, it will better fill the needs of the manufacturing and mineral districts. Going farther down, he fixes 88,000 lbs. as the capacity for a coke car. Why not 100,000 lbs.? There are quite a number of them now, and the coke consumer will be "tickled to death" to get it. Several years ago several of the roads—and I will name them, the B. & O. and the P. R. R.—experimented on making a 100,000 pound steel underframe box car, and after two or three years came to the conclusion that the average box car did not load to exceed 80,000 pounds, therefore, it was not desirable to spend the extra money for the additional capacity. But I want to say that the tendency of the times in the last three years is toward the 100,000 standard. I also want to say that the kind of box car our people believe, is an all steel box car, and we will build 100 of them this year.

To go over the various rules suggested by Mr. Muhlfeld in numerical order, we have the following comment:

Rule No. 1, Distribution—The intent of this rule is not shown from any detail, but there are certain commodities moving in very large volume which it would be impracticable to endeavor to regulate to conform to the periods of greatest supply and demand, particularly if the demand is in a season different from that in which it is most desirable to ship. Take, for instance, the question of ore shipped from Lake Erie ports

to interior furnaces in the summer time for winter storage, or coal shipped from the mines in the summer to Lake Erie ports for the northwest for winter storage and use. The railroads must, perforce, because of the very nature of the traffic, and there being no navigation in the winter, be required to handle in the summer time large quantities of these commodities consumed in the winter.

Rule No. 2, Distribution of cars as between shippers—We concur in the idea set forth, except that if a plant is at a disadvantage for a number of days because of the fact that it has received no cars whatever, when cars are more plentiful recognition should be given to the justice of a request for additional cars over and above the daily capacity, in order that the accumulation can also be cared for.

Rule No. 3, Restricted supply of equipment—It is perhaps fair that something should be done to cause shippers who deliberately and wilfully continue obsolete business methods to be more progressive; at the same time, if he loads his daily quantity of cars, distribution being on the basis of capacity, the question of discrimination as between industries must be carefully considered to avoid any legal complications; in other words, if a man loads his quota daily, even though his methods of loading are obsolete, he has performed his obligations, and you cannot discriminate against him in the matter of supply.

Rule 4, Distribution of cars as between railroads—This is something in which the shipper is not directly interested, but in a car pool or exchange of cars, it is unfair for one railroad to appropriate all the high capacity cars and exchange only low capacity cars in return. There should be a method of equalization of capacity exchanged and interchanged, as a matter of equity. As regards routing of the lading, based on the mileage of the various originating and non-originating lines, this would be impracticable in most cases; a freight car is now really a legal tender, and because of practice and necessity, has and should be permitted to carry its load to any part of the country without transfer en route on any junction point. An initial line car should, in the absence of a foreign car, be permitted to be loaded in any direction, since in manufacture on a large scale short hauls, as well as long hauls, and local as well

as foreign loads are produced and turned out in rapid sequence, and manufacture and shipment would never be successful if car equipment was regulated on the strength of the mileage the business was to be hauled, to the junction point via which to be forwarded, or the route to be used.

Rule 5—We agree fully that unfit cars ought not to be used for long distances, but should be disposed of and put out of existence rather, and replaced by modern high capacity cars; but pending great car shortage, to use them only for local trade, where their use is not dangerous to the load or to the trainmen.

Rule 6, Increase in car load minimum—This is a step in the right direction, and we are at the present time working with the traffic officials in their efforts to increase the minimum from 30,000 pounds to 40,000 pounds single car loads on a good many articles, and we are also prepared to recommend an increase in the minimum for double and triple car loads, just as soon as all railroads have modern equipment to a sufficient extent to permit this additional loading to be done without incurring the penalty of dead freight, i. e., freight charged by the Traffic Department to get a minimum revenue, but not permissible to be loaded by the Operating Department, because of M. C. B. restrictions. There cannot be too much co-operation between the Motive Power Departments and the Traffic Departments on the question of minimums. The freight department cannot exact impossible minimums, i. e., minimums which the M. C. B. people say are not safe.

Rule 7—We agree thoroughly that the best use should be made, according to the character of the car; such things as sending drop-end cars particularly adapted for steel or any like material to coal mines, and giving steel mills firm-end gondolas when drop-end cars are required, are objectionable. The coal mine can load either kind of car, but the steel mill prefers one to the other. The question of maximum lading is of great importance. I have brought with me a photograph of a tubular collapsible or telescopic permanent car stake, the result of efforts of Mr. J. F. Townsend, Traffic Manager of the National Tube Company, one of our members who is out of the city, and who asked me to bring out this point. I will pass the photograph around for those who are interested enough to look at it, show-

ing the use of a permanent stake on a flat car; the stake spread out and raised to its full height on ordinary gondolas or flat cars when so equipped are immediately available for a maximum high load, such as lumber, or pipe, or anything where the custom is to stake the load and bind it at the top with binding wire.

Rule 8—We do not agree on the rule as to the non-use of railroad service cars for the handling of mill refuse. There is a broad question of equity here. Mills on Lake Erie have distinct advantages and have the great lakes into which to waste their refuse; here we have not. The continued existence, successfully, of mills in the interior is dependent to an extent on co-operation by the railroads, and the removal of the refuse by the railroads in railroad equipment from the mills who have no room to waste it, while the railroads have plenty of room along their right of way, is a distinct feature of the equity referred to, and is due by the railroad in return for the millions of tons of freight and millions of dollars which the industry creates for them, and can continue to create if proper co-operation in the matter of handling the refuse question is tendered by the railroads.

Rule No. 9—This is a much mooted question. Coal shippers will tell you that coal from different producing districts cannot be pooled, although one railroad has within the past season pooled the coal at Lake Erie ports from several different mines, but all of the same vein coal. The extreme detention to cars at Lake Erie and tidewater points is great, and tidewater lines have recently made a step in the right direction by fixing a maximum time limit of 13 days after arrival at seaboard on tidewater coal, after which demurrage is charged. A special committee is now at work trying to formulate similar rules on lake coal, but it is a matter of sincere regret to find that those lines whose equipment is most delayed, and in large number at that, the last to be willing to go into an arrangement of this sort. To speak frankly, I am informed that the Pennsylvania, New York Central and other lines are all opposed to a maximum time limit, or a demurrage charge on coal at Lake Erie ports, or oppose an increased demurrage charge for cars placed on railroads and industries tracks for loading and unloading. Where

the industrial railroad's engine places the car, it simply takes the place and does the work of a railroad engine, and free time must be granted to the industrial terminal road for that service which it performs for account of the long-haul carrier.

Rule 10—We agree thoroughly that something ought to be done to rectify the delay to equipment by frequently unnecessary stop-over privileges, particularly for reconsignment. The practice is exceedingly bad on the part of some railroads hauling coal consigned to themselves, held for an indefinite period, and then permitting reconsignment with three days' time in which to arrange reconsignment, to be without any charge for demurrage on railroad equipment because they themselves detain it.

Rule 11—The answer to No. 11 is contained in our remarks on No. 10, there being but little practical difference as to the delay for milling in transit of grain, dressing lumber, compressing cotton, or reconsigning coal or other materials.

Rule 12—We agree that this might be practicable, provided it does not come in conflict with the National laws as regards safe equipment, this being the subject of particular attention at present by the Interstate Commerce Commission in the interest of the trainmen.

Rule 13—We agree thoroughly that system cars consigned to company's use business, the use of which is frequently more abused by the railroads themselves than by shippers, ought to be regulated and corrected.

Rule 14. Tracing for location of delayed shipments—This is a very good suggestion. Many railroads frequently do not know, and lose cars in yards. The record is not taken as frequently as it should be, but it should be the business of every carrier to know what cars are on its rails or sidings, and where, and at what point.

Rule 15—We thoroughly concur in this recommendation as to classification of trains, and to avoid loss of time at intermediate terminals.

Rule 16—The way to get maximum service out of equipment and power is to move the traffic, instead of holding the

cars and the power, and thus losing time and opportunity.

Rule 17—The suggestion is a very good one, and valuable both to railroad, shipper and consignee.

Rule 18—This is more of an operating question, and one which a railroad operating man can answer better than can an industrial man.

Rule 19—The same comment applies to 19 and 20 as to 18 and 21.

Mr. Townsend, one of our members, could not be here this evening, and he asked me to convey a thought which was indirectly in the line of Mr. Muhlfeld's paper, on the maximum efficiency of equipment. Mr. Townsend has designed a tubular telescopic car stake which can be adjusted to a gondola car. I have a blueprint showing the design and also a photograph of a car loaded with pipe fitted with this stake which has made a trip from McKeesport to Washington, D. C. Anyone who cares to look at them, I will be pleased to show them. His idea is that a gondola car fitted with telescopic stakes is a car that is always ready for a maximum load of that kind of material which requires staking.

PRESIDENT: Mr. Terry, let us hear from you.

MR. W. A. TERRY: Mr. President and Gentlemen—It is very gratifying to me to have these advance sheets, because they have enabled me to assist Mr. Muhlfeld to the extent of adding a classification or two. I will read it, with your permission:

"The freight car belongs to the fowl family. During the spring and early summer it can be found in nearly every part of the country, its favorite haunt being near railroad tracks, and it is easy to capture. In autumn, however, like certain other fowls, it goes into hibernation or flies away to other climes. Scattered incidents are known where specimens are captured during the autumn months. A lasso or a well-greased switch crew is sometimes used in snaring a freight car, but main strength is the best weapon. In any case the hunter must be very wary, as any noise like the fluttering of a way bill will make the quarry disappear. Some railways own large flocks

of domesticated freight cars, but they are carefully guarded during the closed season. The wild freight car when caught and fairly loaded up becomes perfectly stationary."

Now, Mr. President, everybody who has talked so far has had a fall out of Mr. Muhlfield, and he and some others have tried to take one out of the traffic department. This one question of increasing the minimums of carloads is probably as difficult a one as any department of railroading has ever undertaken to handle. It must be remembered that our manufacturing has grown immensely and in certain districts plants have become concentrated, and these concentrated plants are able to load very, very heavily. But all over the country there are plants that cannot load up to the same high capacities. It has been suggested among traffic men that possibly we have reached a point where, on account of the desirability of having high capacity cars to carry the loads, it would be wise to have more than one classification minimum. Say 25,000 or 30,000 pounds as the first carload minimum; then 40,000 pounds should be another, and perhaps add still another. That, however, has been attacked by the manufacturers themselves. They say that will give the larger manufacturer an opportunity of getting his goods to market at a lower rate than the smaller one and therefore it would not be fair. Our opposition on that matter has been altogether from the industrial concerns.

Mr. Bihler stated that action was now being had with regard to raising the minimum rates, and that is correct. Most of those commodities that have carried a minimum of 30,000 pounds will probably be in the neighborhood of 36,000 pounds as a minimum and other commodities advanced in proportion.

I shall not comment on No. 3 because it has been found that that would be absolutely impossible under our present law.

No. 4.—I am going to ask Mr. Muhlfield for a little additional information when it comes his turn to speak. He says: "The distribution of cars, as between railroads, on the basis of the number, cubical and carrying capacity of cars of the different classes owned." If he means by that that there should be some arrangement among the carriers so that a carrier will receive in exchange for cars as many as it delivers, so that any road buying cars, no matter how many, may be sure that

on its road it may have in the exchange the equivalent of that ownership; in other words, receiving one car for every one that it sends out, then he has proposed something which to my mind is as fair as anything could be. But there are railroads whose business is almost entirely outbound. He made a point to the effect that light mileage should be avoided wherever possible. Take a railroad like the Pittsburgh & Lake Erie. Our south bound movement is very largely empty and our northbound business is altogether loaded. Therefore we are perpetually sending out cars and would be getting few back if we were dependent on the current run of south bound business to get those cars back under load. Therefore, if what he suggests is that cars were to be exchanged car for car, it would necessarily carry with it a large movement of empty mileage south bound on our road. Even at that we think that should be done.

In connection with that I might just add that if such an arrangement as that did exist between the railroads of this country, the Pittsburg manufacturer would not be short of cars today, nor would they have been during the past year. That may seem an exaggerated statement, but it is not.

As to the disposition of refuse and the cars to be used for it, I am inclined to agree with Mr. Bihler that while there is no legal obligation on the carrier, there is to some extent a moral responsibility upon him to support his manufacturers in the maximum development. Anything that interferes with or hampers that development, hampers the carrier in the movement of the business to and from that plant. How far that obligation should go I cannot say, but that it should be borne jointly and fairly I believe will be conceded by all concerned as an entirely fair proposition.

Now, as to the storage of coal and ore commodities at tide water and lake points, it is a serious question; but if it is to be treated entirely from a standpoint of fair service let me suggest that if the business for the north would move out of this territory all rail instead of by lake, it would curtail the tonnage movement out of this territory very materially. In other words, whatever allowance there may necessarily have been at junction points between the carrier and the next carrier, one a railroad and the next a boat, if you please, never-

theless the movement has been so much more prompt in the return of that car in lake trade than would have been had it moved all rail and carried that load to its final destination, that the manufacturers and every user of cars in this territory have been benefitted rather than otherwise.

Through billing.—For one year the accountants have had in effect an arrangement for through billing from one point to another throughout the United States. I see one accountant here who I think will support that statement. Am I right, Colonel? For a year at least, and it is being developed as rapidly as it can be. There are some difficulties in connection with it, but it has been felt to be a good thing and has been pushed along on that account.

Just a word also about the question of the neck of the bottle that Mr. Prall referred to. I do not know much about the kind of bottle he may refer to, but it would be a very good thing if there could be sufficiently close relations between those who are about to build a manufacturing plant and the carrier, so that that plant would not be erected until after the ground plans for it had been submitted to the railroad engineer—not that the railroad engineer should dictate as to what those ground plans should be, but it is the common experience of our own people that when manufacturers proceed to erect their plants, they fail to provide what is an absolutely necessary thing from the railroad standpoint, as Mr. Prall has stated, track room enough to prevent requiring two or three or four shifts to do the work that one ought to do.

Just a word about the 50 ton coke car. The railroads will welcome them, the consumer will welcome them, but it will come only in time, as the shipper will not welcome it until an entirely new field of coke has been opened up. The new fields are pitching their platforms so they can load these new high cars. The company I represent has just built what we think the ideal coke car, but it cannot be used in the old Connellsville coke district. It can only be used in the new developments that build facilities to properly take care of the higher design of car.

As to Mr. Townsend's car stake, it is worthy of commendation. We are perpetually up against the question of paying

for the racking and staking of cars and other items of expense which are necessary to get the maximum load on a car. I believe every gondola car and possibly every flat car should be equipped with a stake of this character. I had the pleasure of visiting Versailles and seeing the demonstration at the time that car was equipped with this stake and it is along the right lines. It may lack in some details, but the principle is right, and they are working on whatever weaknesses there may be. I believe every railroad representative ought to give careful consideration to a feature of that kind.

PRESIDENT: In reading the paper over I recognized well the earmarks of a practical railroad man. While Mr. Prall was talking I could hardly determine whether he represented the railroads or the shippers. Mr. Bihler was very outspoken and it was very easy to determine whom he represented. Brother Terry, when he started out, I thought had joined the poetical profession. Now we would like to hear from our modest friend, Mr. Kirk, and possibly before he is through we will recognize whom he represents.

MR. T. S. KIRK: The advance copy having been delayed, reached me this evening too late to admit of reading and digesting it. In consequence I find myself unprepared to enter upon a discussion relative to the subject before the house. Mr. Muhlfeld has in a masterly digest covered his subject so thoroughly, that if anything remains untouched upon, it is but fair to say time and space are alone responsible. It is my opinion, however, that the earning capacity of freight cars cannot be accomplished through the increase of the capacity of the car so much as diminishing the running time and seeing to it that the idle time is conserved, that is to say, a car is serving its purpose only when engaged in carrying its load between the point of origin and the point of destination. It is admitted that the active time of the car bears but a very small relationship to its waste energy, were it possible to gain in movement an approximate value of the car. I think we should expect with rolling stock as it now exists, in the number of cars and their capacity, to more than meet the demand of the shippers.

In a concentrated load the supporting structure must of necessity be strengthened, while the same weight distributed

may be safely supported by a less ponderous preparation. This leads me to conclude that it would be better to confine the capacity of the car to reasonable limits, and by increasing the number of cars conserve the same end by distributing the weight over a greater length of trackage. To meet the proposed increase in the capacity of cars will of necessity make it imperative that the railroads must widen the gauge of their tracks, must rebuild their bridges and tunnels, increase the weight of their locomotives—in fact it means that all previous expenditures must be cast aside and a new creation be installed.

Get your cars into service and consider each car as a part of the necessary equipment for creating revenue. See to it that the shipper does not abuse them by diverting them to his private use for storage purposes. Favor no one at the expense of another, and you will have accomplished your duty to the public and will have nurtured your own individual interest.

A few words in regard to Federal legislation. I would say the Chief Executive and the co-ordinate branches of our National Government are elected by the people to safeguard their interest while they pursue their various avocations. They ask no more than justice and will accept nothing less. Happily, we have in Theodore Roosevelt an earnest, honest and a fearless champion, who seeks to retrain only where the law has been violated. It was his undaunted courage and fidelity, in spite of the opposition of the professional politician and Wall Street gambler, that inspired the public to marshal their hosts and in overwhelming numbers carry the standard of honest government triumphantly forward. We, the people, elected Roosevelt, and so long as he steers the ship of state to a safe mooring we mean to stand by him. We want no more examples like the Chicago & Alton Steal. We want honesty and would ask at the hands of our Government that the same justice be meted out to the rich that is dealt out to the poor. No more and no less. One law for all is the slogan of true democracy.

Before closing my remarks I wish to suggest one necessary change in the construction of a car for shipping structural material. We are all aware of the unsafe loads that are now constructed. The consumer is in the habit of ordering lengths that require two or more cars for its transportation. We take

the ordinary gondola or flat car and by placing supporting blocks, say 12x12, one or more on each of two cars, we proceed to build up our load. The weight will range from 60,000 pounds to 125,000 pounds net. This weight, you will observe, has but 24" of resistance to overcome the inertia of a movement of say forty miles an hour. Should the engineer be compelled to slow down or stop his train (assuming the cars are equipped with air) he puts on his brakes and brings his train to a dead stop in a few yards. He controls the cars, but what about the load? It goes marching on. I am prepared to say there never has been a safe load when two or more cars are necessary to care for the length. To overcome this unsafe practice, I would advocate a car with an inside measurement of 60 feet in length, or a length that will accommodate a bar 60 feet long.

The capacity of the car need not exceed the present limit of 100,000 pounds. When this car is placed in the trade the railroad should, except when special provision is made, refuse to transport material whose length exceeds the limit of the car. The manufacturers should be forced to co-operate, and I maintain it to be to his advantage to do so. If no restraint is placed on the length, some day the manufacturer will find himself compelled to erect heating furnaces of such dimensions as will require more space than his present site will afford. I thank you, gentlemen, for your attention.

PRESIDENT: It is seldom that we have the pleasure of having with us Mr. Postlethwaite, and we would like to hear from him.

MR. C. E. POSTLETHWAITE: Mr. President—I think the subject has been very well covered and it is hard to add anything, but I might say a word as to car capacities. Mr. Muhlfeld refers to general service cars as 125,000 pounds capacity. There are roads operating cars hauling that much freight or coal today. The Chesapeake & Ohio is one of them. Mr. Stevens told me a short time ago that they were loading on their gondolas from 115,000 to 126,000 pounds of coal. There is a little objection at interchange points, and on those cars they have tried to cut it down a little.

There is just one other point. In talking about car capacities we may think that we are just a little ahead of the times. I

think Mr. Muhlfeld has made rather a low mark at 125,000 pounds. I have in mind an instance that was told me by the late Mr. Kimball, who at the time was President of the Norfolk & Western. In 1876 he designed and had built a steel frame box car of 80,000 pounds capacity, and the territory over which they thought it safe to operate a car of such enormous capacity was so limited that the car was finally sidetracked and no more attention was paid to it. That seems absurd in the light of developments of the present day. Mr. Harriman was credited with the statement a short time ago by the newspapers that the railroads of this country would have to be rebuilt and cars much wider and of practically double the present capacity would have to be built to take care of the business, and it is simply up to us, who are trying to look after these things that interest us all so much, to keep pace, and I think the railroad people will find the car manufacturers ready and willing to produce anything they want at the right time.

Mr. Terry's definition of a freight car from my own railroad experience I can vouch for, and Mr. Bihler mentioned wheels as the one weak point in car construction. But with the bright minds that are in the railroads at the present time the subject of wheels will be taken care of at the proper time, and they will produce wheels that will carry the car and load.

PRESIDENT: I might add for the information of Mr. Bihler that the Railway Club of Pittsburg first took up the matter of increasing the strength of cast iron car wheels. This, in turn, was referred to the Standing Committee on Standard Car Wheels, and again was referred to the American Railway Association. At our last convention the thickness of the flange was increased. The purpose was to work through the engineers of maintenance of way department and increase the clearance of throats of frogs and crossings so that ultimately we may have a much stronger wheel. And I might say for Mr. Kirk that we already have freight cars 64 feet long. It was my privilege to design a car for the United States Steel Company and it has been operating out of Lorain for a number of years very satisfactorily, though it would not be a practical car for commercial service.

We have with us a number of visitors whom we would

like to hear from, but we have a social hour after this, and the hour is now late, and I will ask Mr. Muhlfeld to answer such inquiries as he may see fit.

MR. J. E. MUHLFELD: I think you will, no doubt, all agree with me that it is quite a thankless task to prepare and present a paper of this kind, but I feel fully repaid by the discussion that has taken place this evening, which I have enjoyed very much, and will attempt to reply to some of the points that have been brought out.

Mr. Prall struck the keynote when he urged the necessity for collective work and co-operation, and that is what I had in mind generally when preparing this paper. In regard to his remarks about interchange and holding tracks, we can appreciate from situations that come up every day the necessity for adequate interchange and holding tracks; but these will have to be developed the same as the terminal facilities of industrial concerns.

With respect to the interchangeability of freight car parts and the individuality of mechanical men—the time has come when the railroads must get down to a strictly business basis in the operation. They must reduce the cost for substantial maintenance to a minimum, and to accomplish this and facilitate interchange of equipment and the movement of traffic it is necessary that car bodies as a whole and trucks as a whole shall be standardized and made interchangeable with respect to the general dimensions and design, and I have no doubt that in the next year or two this will be worked out in connection with new equipment.

In regard to the payment of a premium on cars held under load in addition to the demurrage charge—I think the railroads are now paying a sufficient penalty without reciprocal demurrage. The present demurrage rate does not come anywhere near reimbursing the railroads for the depreciation and loss of the use of the car while waiting for or under load. For example: A steel car loaded with coal will depreciate very much more rapidly when standing idle, especially during wet weather, from the effect of the mild sulphuric acid and other corrosion on the sheets, than when it is in operation. When we continue to load, unload and keep such equipment in move-

ment the depreciation by corrosion of the sides of the sheets in contact with the lading is materially restricted. This can be likened to the life of a steel plate that is exposed to the weather and out of use, as compared with a similar plate that is constantly subjected to service under the same weather conditions. On the former the rust scale will accumulate and depreciate the plate very rapidly, while on the latter the frictional action and vibration will prevent such corrosion. Thus by keeping cars in their legitimate service we retard the depreciation of those surfaces that must come in contact with such lading as exerts a corrosive effect and which surfaces we have been unable, to the present time, to properly protect. Therefore, while the life of a substantially designed and constructed steel car may be almost unlimited when properly made use of and maintained, its depreciation becomes exceedingly rapid when subjected to such usage for which a demurrage rate is now charged that is insufficient to cover even the earning capacity of the car to the owner, to say nothing of its physical and obsolescent depreciation and the interest on the investment.

The question as to how a public storage might be provided was brought up and I have thought that it might be well for mercantile, marine and railroad corporations who are concerned in domestic and foreign commerce to consider providing facilities of that kind at points of general use.

Mr. Bihler brought up the item of steel wheels for high capacity cars, and Mr. Stark spoke of the action of the M. C. B. Committee on Cast Iron Wheels. The railroad with which I am connected has, during the past three years, gone into the cast iron wheel matter quite exhaustively, and we have found proportionately as many failures of wheel flanges on 60,000 pounds capacity as on 100,000 pounds capacity cars. In going over the records for the last two years we find a very material percentage of reduction in the failures of 750 pound cast iron wheels as compared with the 650 pound wheels of the design previously in use under the same class of equipment. However, should it develop that something better must be provided, we can then go to the use of a refined cast iron wheel with a full double plate, which gives a good distribution of the material with the present tread and flange contour; or to a forged steel

wheel with hardened tread and flange wearing surface and which would not necessitate the re-turning of tires and could be secured on a guaranteed mileage and scrap value basis and be suitable for a 125,000 pounds capacity car.

In regard to coke cars of 100,000 pounds capacity—we fitted some 60,000 pounds capacity coal cars with coke racks and afterwards had to cut openings down the sides in three different locations on account of low ovens. There are at present only certain ovens where 100,000 pounds capacity cars can be loaded, and when the ovens are generally arranged to take care of 100,000 pounds capacity cars there is no doubt that they will be provided. A car of that kind should be all-steel, although at present we are using principally wooden equipment which can be readily adapted to the larger cubical capacity and the low weight limit.

With respect to revenue service cars being used for the handling of mill refuse—I agree with Mr. Bihler that in the interior localities, such as Pittsburgh, where there is not the opportunity to divert the refuse to tidewater or lake ports, it is necessary to use railroad equipment for disposing of it. However, I have always thought that instead of taking for such lading the best equipment having the largest capacity for the loading of finished manufactures, as is generally practiced at present, it would be more advisable to assign certain inferior classes of equipment for that class of traffic.

In regard to side stakes—there is no doubt but that the railroads should furnish cars suitable for the lading they are to carry, so far as retaining the load on the car is concerned, but when it comes to dunnage required by shippers between various parts of the total lading or such as may be required to support irregular lading in certain definite required positions, for certain weight and clearance limitations, that is a matter that the shipper should take care of. If it is found that a steel stake is necessary and desirable in order to complete certain car equipment so as not to discriminate between shippers, and a substantial, simple and safe arrangement can be devised, the railroads will, no doubt, be ready to take it up.

Mr. Terry talked of domesticated and bad order cars, and I can thoroughly appreciate the situation. However, when a car

becomes in bad order its continuance in that condition is usually due to the shortage of labor or material, or both, required to make the repairs. I think all railroads are at present experiencing difficulty in repairing cars which could be put into service if they could secure materials of certain general sizes and which could be furnished with reasonable delivery.

In regard to the inquiry that Mr. Terry makes as to the recommended distribution of cars as between railroads—his interpretation was in line with my idea that a railroad company should be permitted to retain on its tracks at all times equipment equivalent to its official stock, and its official stock should be adequate to meet the requirements of the traffic originating and moving on its line. A railroad that originates traffic, of course, requires a great deal more of its own equipment than one that does not. It may secure lading for a 35 or 50 miles haul over its own line and then have to turn it over in one of its own cars to another railroad which gets the greatest benefit from the rate and the car. It was with a view of equalizing the situation that the rules specified in item 21, under "Distribution and Movement," were brought out, and if such rules could be inaugurated I believe it would more nearly result in the distribution of cars as referred to in item 4 than at present.

In regard to the 60 foot freight car that Mr. Kirk made mention of—I fully agree that it is better to put integral lading on one car than to distribute it over two or more cars. Many delays and even accidents occur on account of such lading being placed on double and triple cars. But when it comes to building a freight car to operate around a commercial track 60' radius curve it is quite a difficult proposition, on account of the limited side clearance. While passenger cars have been and are now being constructed 70 feet and 80 feet in length, a 14-section Pullman car, for instance, will have a load of about 5,000 pounds, while the capacity of a 60 foot freight car, such as Mr. Kirk would desire, would probably have to be 250,000 pounds. When it comes to the 125,000 pounds capacity freight car, the Baltimore & Ohio now has about 7,500 cars marked 100,000 pounds capacity, but which can be loaded to 125,000 pounds distributed, or 83,000 pounds concentrated lading. When we speak of going beyond 125,000 pounds of lading per car

we must also take into consideration the bridges, roadbed and rail that the car must move over. A serious difficulty that railroads are now experiencing is due to broken down and defective rails that occur mainly on the lines traversed by loaded freight cars, rather than by the heaviest capacity locomotives. Therefore, before we increase cars beyond 125,000 pounds capacity it is necessary that some improvement be made in connection with rail, roadbed and other operating features that must be taken into account and which, it appears, has not been advanced to the same extent as the motive power and rolling stock.

MR. BIHLER: I would like to ask one question in regard to lumber used in blocking loads of steel. There are two kinds of lumber in use, one for the convenience of the shipper or consignee, the other as described and diagrammed in the M. C. B. Rules. May I ask what kind it is that Mr. Muhlfeld had in mind as a part of the carrier's obligation to furnish and assume the cost of?

MR. MUHLFELD: For example: If two shippers have the same amount and class of lading for movement and the railroad furnishes one a box car into which he can place his lading without the necessity for dunnage and the other with an open car on which it is necessary for him to put side stakes in order to carry the lading, then I think it is in line for the railroad to assume the expense of or provide the stakes. A railroad should not, however, furnish or assume the expense of dunnage for assembling a load of individual pieces in one or more suitable cars to build the same into a load and retain it in safe and proper condition for movement.

Permanent side stakes might be considered as a part of flat or low side gondola car equipment if they can be devised in a simple and substantial form and are required to retain lading up to the maximum weight capacity for which such cars are furnished.

MR. BIHLER: What I had in mind, if you have a superimposed load extending over two cars, or a double load on the floor of two drop end cars which should be blocked in such and such a way, and it costs so much; it is used to support the load, and in addition you enumerate the amount of space for clearance on either side of the load, all of that is described

and it costs today about 15 cents per ton on the weight carried—What I want to get at is whether in your mind as a matter of equity the duty of providing that blocking or assuming cost should be on the carrier.

MR. MUHLFELD: No, sir; not a car loaded with an overhanging load at one end.

MR. BIHLER: A double load?

MR. MUHLFELD: A double load.

PRESIDENT: We have a report from Mr. McFeatters.

MR. F. R. McFEATTERS: Your Committee appointed to consider the matter of an entertainment or banquet met yesterday and talked over the matter and decided that nothing ought to be done at present. That this would not be an opportune time to have it, just before the coming vacation, as there are but two more meetings before the vacation.

MR. D. J. REDDING: I think this entire audience realizes that we have just listened to the reading and discussion of a very valuable addition to railroad literature, and I move that a vote of thanks be extended to Mr. Muhlfeld and the gentlemen who have taken part in the discussion of this paper.

The motion, being duly seconded, was put to vote and carried unanimously.

ON MOTION—Adjourned.

“Contributed.”

Mr. F. H. Stark,

President, Railway Club of Pittsburgh,
Pittsburgh, Pa.

Dear Sir: I have read the advance copy of Mr. Muhlfeld's paper on "Practical Means for Increasing the Earning Capacity of Freight Cars," and regret very much not being able to attend your meeting, evening of March 22nd, and hear the discussion on the many good points touched on by him in presenting this paper. To my mind Rules 15 and 18, which Mr.

Muhlfeld brought out for consideration, get at the very heart of the transportation problem; and while some of the suggestions pointed out by him have already been the subject of discussion at conventions and in committee meetings of various railroad associations, nothing definite has been done, or at least I have never heard of any action looking towards the collection of data with the view of determining whether or not the suggestions embodied in the foregoing rules are possible of practical results.

In Rule 15 he suggests, "The classification of trains to increase the main line movement of cars through or around the greatest possible number of intermediate terminals and to reduce the switching movement"; and in Rule 18, "The running of trains after regular intervals and with respect to the destination of cars rather than from one divisional terminal to another."

It is seen at a glance what a radical difference exists as between present day methods and the suggestions as above, and it is to be assumed that on account of the apparently insurmountable difficulties presented at first glance, the questions that he raises have hardly been touched on in any direction. The surface has not been scratched, to say nothing of any ground being broken. To bring the matter of movement under the rules suggested up to a point approximating fairly ideal conditions might require considerable addition to terminal facilities, and would require a great outlay of money, no doubt, in the building of new yards to be used as centralization or shaping up points.

During the past ten years or more the various associations interested in the transportation problem have been gathering voluminous statistics along various lines with the view of increasing car efficiency and improving the handling of freight. That success has followed their efforts in some degree seems to be amply demonstrated by Interstate Commerce Commission statistics covering the period of 1895 to 1905. They show a gain in locomotives of 35 per cent, freight cars, 45 per cent, while tons freight hauled one mile show increase of 118 per cent. When we consider the fact that the average miles run per car per day has been steadily decreasing during the past few years, it must be admitted that "car efficiency" along the line

of largely increased unit capacity is to be credited in a very great measure with the largely increased tonnage being hauled at this time. It is, therefore, to the credit of the car departments that such good results are in evidence, and it is also gratifying to note in Mr. Muhlfeld's paper further ideas of betterment along the line of increased efficiency in cubical and tons capacity per car.

When we stop to consider the great increase in freight actually hauled as reflected by these statistics, and then give due heed to the universal cry of car shortage constantly in evidence in recent years, we must conclude that the percentage of increase might have been as much again had the railroads been able to promptly fill all requirements. Allowing for the probable element of exaggeration on the part of shippers in their complaints as to tonnage lost by reason of car shortage, there still remains the absolute knowledge of very many bona fide cases throughout the country where big industries have been and are now frequently kept below their maximum output for periods of weeks at a time. Such a commotion has been made in all quarters that our National administration has seen fit to take the matter up and begin an investigation, and it is to be sincerely hoped their efforts will be productive of material results and their conclusions tempered with the "square deal" element for both the shipping public and railroads alike.

To ascertain the feasibility of running trains with respect to destination of freight, why not compile statistics to bring out just what tonnage is being offered daily, and to what points consigned? For example, should the P. & L. E. Railroad make up figures of this kind, it would no doubt be found that the greater bulk of their long haul tonnage is originated at and south of Pittsburgh. So much is destined to Youngstown, Cleveland, Detroit, Ashtabula and to points via the Toledo and Buffalo gateways. In fact, result of check would very likely indicate that the greater bulk of freight offering daily is destined to from six to ten large cities, and the next step would be to assign certain yards or portions of yards for the exclusive use of such freight in respective order. The shipper should then be taken into the scheme and arrangements perfected whereby cars loaded by them would be placarded "Youngstown,"

"Cleveland," "Detroit," and so on. The greater bulk being taken care of, there remains the freight for local points on home line, together with the one and two car consignments for here, there and everywhere outside of the six or ten large cities already provided for. The shipper knows where his car is going, and it might be arranged to have such cars placarded "Local P. & L. E., North or South," "Local Erie, East or West," "Local Lake Shore, East or West," and so on. This would necessitate the assignment of a few more tracks for the exclusive use of these respective odds and ends.

There would still, of course, remain the necessary drilling of cars after being taken out of shippers' sidings and yards. All could be taken out together and split up after reaching assembling yard, the assembling yards to be located with respect to the bulk of tonnage offering. Dickerson Run could, no doubt, take care of the coke proposition nicely. Yards at Glassport and Lynch, for instance, take coal and other freight from Monongahela and Youghiogheny divisions. Freight originating at McKeesport to Homestead to be assembled at the latter place, while McKees Rocks would take care of all out of Pittsburgh proper. The latter point would hold the key to the whole proposition. Yard master could control situation and be in position to order down a mixed train of say 50 cars of freight for Youngstown, Cleveland and Detroit. These 50 cars, with what is already available at McKees Rocks, would go to make up three solid trains for each of the points named. The proposition would work out the same on the odds and ends, care only to be taken to see that in making up such trains only freight for "Local Erie, West," or "Local Lake Shore, East," and so on, is put into them.

Move on to the next heavy tonnage producing center and follow out on same line. For instance, Youngstown could tell McKees Rocks to let so much such and such freight come along, Cleveland do the same for Youngstown, and the procession would be started.

This no doubt sounds like the incoherent ramblings of a "brain storm" victim, and the P. & L. E. will no doubt wonder where they would be ahead of the game in making things easy for the roads beyond. There's the rub. A start must be made

somewhere, and as the president of one of our leading railroads has well said in commenting on existing conditions, "It is the attempt to draw off water by a pipe one inch in diameter from a reservoir into which is constantly flowing water from a pipe three inches in diameter." It is about time to give some consideration to what might appear as radical and at first glance wholly impracticable suggestions. We are now in the experimental stage of the car pool theory, and a great many of the roads have also recently gone into a car hire agreement, by which they are obligated to pay each other an increased per diem rate for the use of each others' cars, the increased rate, no doubt, being based on the theory that return of cars would be hastened. So long as the earning capacity of a car is away in excess of established car hire rates, car owners can expect what have come to be known as "pirate roads" to hold and use their equipment, for the very simple reason that it is cheaper for the "pirates" to pay the car hire than it is to maintain cars of their own. With respect to a universal car pool, it is difficult to understand how the movement of freight is to be improved by the inauguration of such a scheme. It might have a beneficial effect on general car distribution when same are available, and provided they are able to move the cars. But how very often it happens that embargo conditions at one point covering freight destined to one particular road has the effect of demoralizing conditions for hundreds of miles back. This is more forcibly true when the road embargoed is reached via what is known as a channel or gateway for the great volume of freight moving East or West, North or South, as the case might be. The writer has had frequent evidence of the helplessness of railroads under such conditions, and has in mind a recent instance involving a very great many cars in which the movement Pittsburgh to Toledo averaged 15 days each, numerous individual instances ranging from 15 up to 30 days, on a movement which, under fairly good conditions, ought to be covered in three or four days. One road at Detroit had embargoed its connections, and on account of present day method of starting out trains made up without regard to final destination, the shipments in question were tied up all along the road, notwithstanding they were routed via Toledo and over a road standing ready to take freight as fast as it could be gotten to

them. The holding roads were reclaiming against the embargoing road only on cars en route to that road. How about the per diem on the great number of cars not subject to this embargo? It amounted to a considerable figure and had its due effect on net returns in freight on that particular trip, but at that it was cheaper to hold the cars and pay the per diem than it would have been to attempt to separate the wheat from the chaff by drilling out non-embargoed cars held on sidings and in badly congested yards. Why should the whole country suffer by reason of a purely local condition of this nature? Anyone with imagination can follow up this clue as an ever present and potent reason for car shortage, and if he will follow out a little farther it will also serve as a reason for one of the prevailing causes of the grief and turmoil due to consignees' inability to unload. When embargoes are lifted all the roads get busy and crowd Tom, Dick and Harry with all the freight that has been piling up daily for 10 or 15 days, and Tom, Dick and Harry must be content with the explanation that delay was due to conditions on the A. B. & C. road, say at Cleveland; Tom, Dick and Harry being located on the D. E. & F. at Youngstown, one hundred miles on the lee side of the trouble, do not fully understand why they are expected to fly around and tear their shirts simply because of some one else's shortcomings, and what is more, they keep their shirts intact, and meanwhile the cars suffer additional delay.

Trains made up with respect to final destination of cars would get away from the conditions named, at least in a very great measure. Then take into consideration the big saving in time in transit, and figure out what it would mean in car supply. I venture what seems to me a modest assertion, and make the statement that the least we might look for would be one additional load per car per month. There are something over 1,500,000 freight cars in the country, and if the inauguration of some such scheme as outlined would result in giving us each one of these cars for one additional load each month, or let us be modest and say one-half a load, it is readily apparent that the increase in revenue each month would well justify large outlays for improvements in present facilities and the building of centralization or shaping up yards.

The flood here in our home town a week or two ago had an object lesson emphasizing the good sense of running trains with regard to final destination of cars. All our big industrial plants were paralyzed for several days, and it took a few more additional days for the railroads to get back into their normal stride. Would it not be nice to be in position to issue notice to connections embargoing Pittsburgh freight for two, five or ten days, as conditions might warrant? It is easy to see that cars for hundreds of miles on each side of flood, destined via junction points not affected by the conditions, would be free to go on their way rejoicing. If it isn't a flood at Pittsburgh, there's a snow storm beyond St. Paul on the West or Buffalo in the North. Freight for all points back to Chicago in one instance, and to Pittsburgh in the other is delayed as a consequence. It will do no good to indulge in any more language. Every railroad man realizes all that has been said and will hardly insist that present day troubles have been overdrawn.

The membership of the Railway Club of Pittsburgh, made up of railroad men from all departments and shippers representative of nearly every kind of tonnage offering here, should be in position to get together on this proposition and see if it is not possible of achievement.

Yours truly,

J. L. O'TOOLE.

In Memoriam.

D. L. MACOMBER

WHEREAS, God in his all-wise providence has taken from our midst D. L. Macomber, therefore, be it RESOLVED, That we, the members of the Railway Club of Pittsburgh, express our deepest sorrow at the great loss of a most valued and respected member, and a warm and genial friend.

RESOLVED, That our sincere sympathy is tendered to his family in this their hour of bereavement.

RESOLVED, That these resolutions be engrossed on the minutes of the Club, and a copy be sent to the family of our deceased member.

D. M. HOWE,
D. C. NOBLE,
A. B. BELL,OWS,

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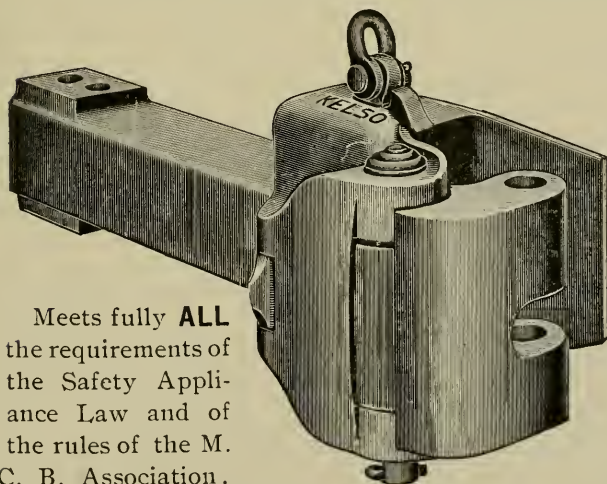
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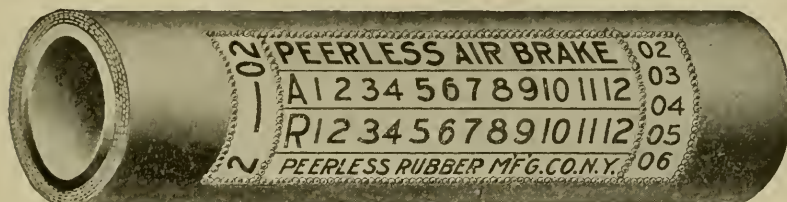
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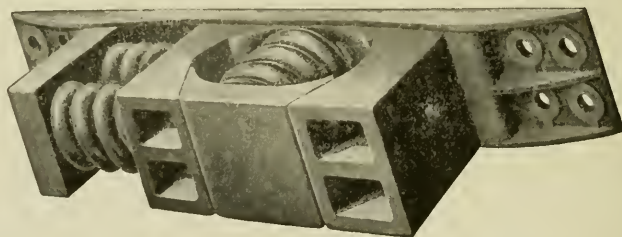
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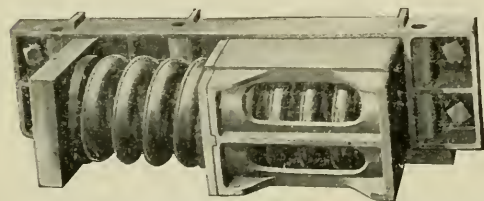
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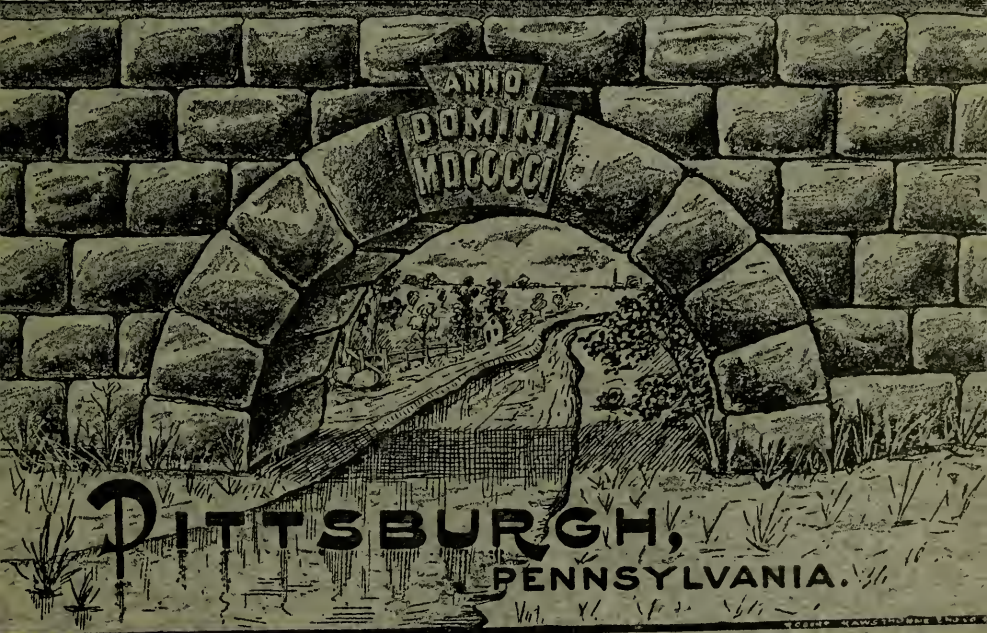
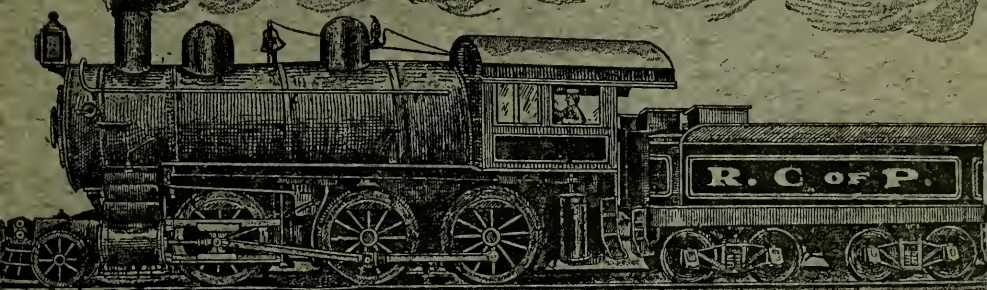
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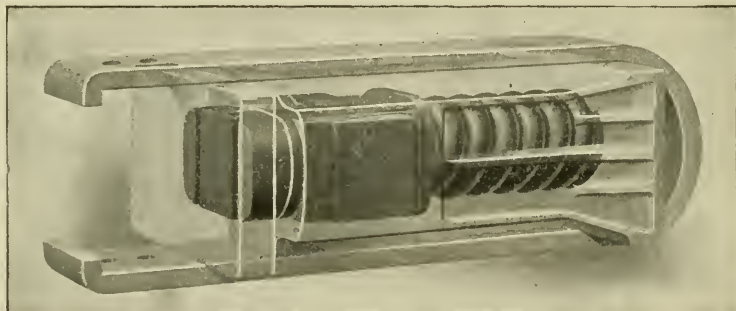
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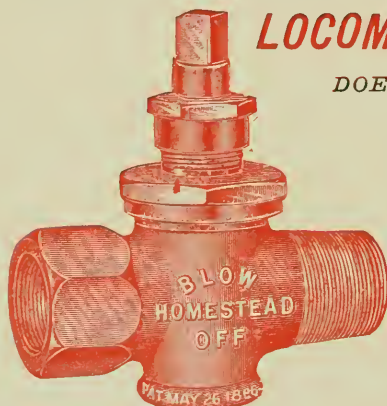
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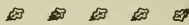
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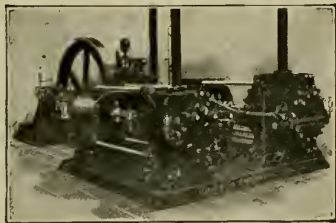
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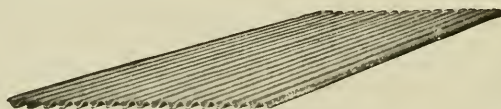
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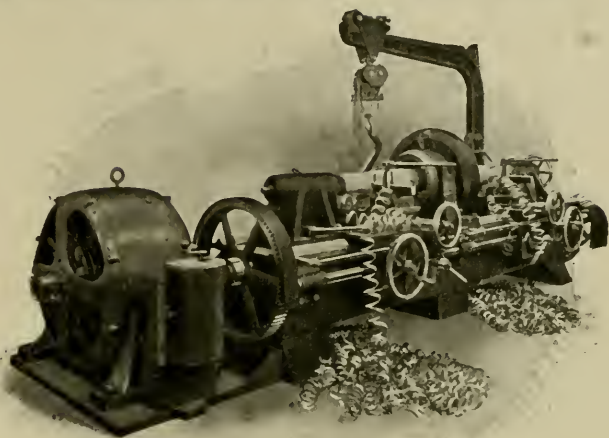
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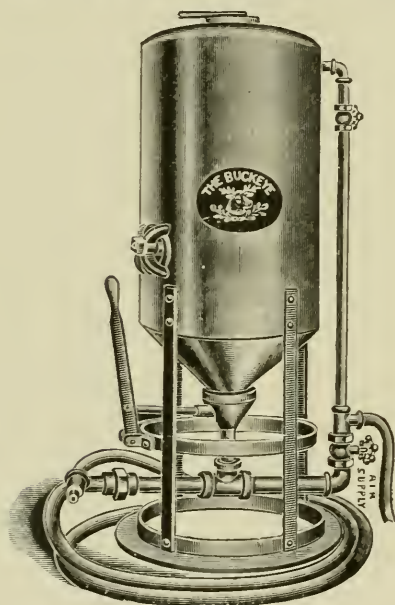


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of the
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ORGANIZED OCTOBER 18, 1901.

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Meetings held fourth Friday each month, except June, July and August.

**PROCEEDINGS OF MEETING,
APRIL 26th, 1907.**

The meeting was called to order at the Monongahela House, Pittsburgh, Pa., at 8 o'clock, P. M., with President F. H. Stark in the chair.

The following gentlemen registered:

MEMBERS.

Anderson, H. H.	Irwin, O.
Barnsley, Geo. T.	Jenny, Jacob.
Bealor, B. G.	Kennedy, Jas.
Beatty, E. G.	Kinter, D. H.
Bellows, A. B.	Kleine, R. L.
Brand, Thos.	Knickerbocker, A. C.
Brown, Geo. P.	Knight, E. A.
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Burns, Robert.	Laughlin, C. W.
Burrell, J. E.	Moore, Chas. L.
Caldwell, J. H.	McDonnell, F. V.
Carson, G. E.	McNulty, F. M.
Conway, J. D.	Nickerson, S. N.
Coulter, A. F.	Patterson, S. H.
Courson, Chas. L.	Patterson, W. K.
Courson, J. F.	Peacock, W. W.
Cox, P. L.	Phelps, W. H.
Crawford, Harry M.	Porter, H. V.
Culbertson, O. F.	Quest, W. O.
Currie, J. C.	Randall, E. J.
Curtis, H. C.	Reeve, F. J.
Dawson, W. J., Jr.	Robinson, F. M.
Daugherty, J. B.	Rosenstock, Jas. H.
Dorr, C. O.	Ryan, Wm. F.
Dow, G. N.	Searles, E. J.
Drayer, U. S.	Shaler, Fred. J.
Duckham, A. E.	Smith, D. W.
Dyer, J.	Smith, M. A.
Edmonds, J. F.	Stark, F. H.
Gale, C. H.	Storrs, C. P.
Gilg, H. F.	Stucki, A.
Gormley, C. H.	Suckfield, G. A.
Grove, E. M.	Swartz, H. E.
Haring, Ellsworth.	Sweeley, G. P.
Herrold, A. E.	Synnington, C. J.
Hill, M. H.	Watts, H. W.
Hindman, S. M.	Weisbrod, J. F.
Howe, D. M.	White, F. B.

VISITORS.

Alleman, C. W.	Hommel, G. H.
Anderson, J. B.	Huggans, J. H.
Baker, J. H.	Lamon, Judson A.
Barth, John W.	Lichtenfels, P. H.
Berry, K. S.,	Mason, E. F.
Cox, F. W.	Murphy, A. G.
Fitzgerald, D. W.	Reynolds, John N.
Gilg, Harry F.	Robertson, J. F.
Harvey, R. A.	Walbank, R. T.

Whalen, J. A.

The minutes of the last meeting being in the hands of the printer, the reading of them was dispensed with.

The Secretary read the following list of applicants for membership, which was referred to the Executive Committee for action:

J. B. Anderson, Chief Clerk to S. M. Power, P. R. R. Co., Union Station, Pittsburgh, Pa.

J. H. Baker, Clerk, Motive Power Dept., P. R. R. Co., Union Station, Pittsburgh, Pa.

W. D. Brooks, Local Manager, Pittsburgh Plate Glass Company, Pittsburgh, Pa.

Robert C. Burns, Foreman, Car Inspectors, P. R. R. Co., No. 718 Howard Ave., Altoona, Pa.

F. R. Dickinson, Chief Clerk to Storekeeper, B. & L. E. R. R. Co., Greenville, Pa.

Chas. L. Fischer, Draftsman, Penna. Lines, Allegheny Shops, Allegheny, Pa.

G. H. Hommel, Manager, C. Davis & Co., 812 Greenfield Ave., Pittsburgh, Pa.

P. D. Martin, Representative, Pittsburgh Plate Glass Company, Pittsburgh, Pa.

W. J. Neison, Chief Clerk, Freight Accounts, P. & L. E. R. R. Co., General Office, Pittsburgh, Pa.

T. H. Russom, Superintendent Car Department, B. & O. R. R. Co., Baltimore, Md.

Chas. P. Storrs, Manager R. R. Department, Storrs Mica Co.,
Owego, Tioga Co., N. Y.

J. W. Wright, Passenger Conductor, P. & L. E. R. R. Co., Box
16, Dawson, Fayette Co., Pa.

SECRETARY: The Finance Committee of this Club held a meeting last Friday. The Chairman could not get here to-night, but he said he thought it would be well to have the report of their meeting read. The report is as follows:

Mr. President and Gentlemen:—Your Finance Committee met on Friday, April 19th, to give consideration to the financial condition of our Club, appreciating that this feature of the organization is quite essential to its success.

Your Secretary has shown us that there is due the Club by delinquent dues something over one thousand dollars. The notice of dues of each member is mailed him under personal cover each year just prior to our annual meeting, so there should be no reason for the member neglecting payment. We have looked over the list of those delinquent, some few who owe for two years, and are informed that additional notices have been sent them without response. We believe it would be well for you to make public mention of this at the next meeting so those members who are in arrears will give this their prompt attention.

We will issue a circular notice to all those delinquent in payment of dues which will be final, and those failing to respond will be, in accordance with our By-Laws, dropped from our membership.

We would also suggest that the question of life membership, upon payment of a certain fee, be presented to the Club for consideration.

MR. D. M. HOWE: What is the limit that a member can be back in his dues?

SECRETARY: The By-Laws and Constitution require that notices be sent out just prior to the Annual Meeting in October of each year. If a member fails to pay his dues within thirty days after receiving notice, he is suspended without any action of the Club. The By-Laws and the Constitution are printed in full in the October Proceedings each year.

ON MOTION, the report was received and filed.

PRESIDENT: I am glad that we have so many present to-night, and surely this is a good representation of our Club membership. The subject to-night is perhaps one that does not interest as large a percentage of our membership as many of our subjects do. However, this is one of the most important of all the subjects we consider annually. We have a report to-night from our Standing Committee that is worthy of commendation. It is presented in their usual frank, logical manner, and I trust every person here will feel free to take part in the discussion.

We will take up the rules seriatim, asking the Secretary to call out the numbers, pausing just an instant between each number, and if any member has any suggestion to make regarding any rule he will be at liberty to do so as the number is called. The Chairman of the Standing Committee will offer such recommendations as the Committee desire to make.

If this is satisfactory the Secretary will proceed in this manner.

The report of the Committee was then read as suggested, and with a few modifications was adopted. The report as corrected and presented follows:

Report of Committee, Railway Club of Pittsburgh, Revision of M. C. B. Rules of Interchange.

Mr. President and Gentlemen:

Your Standing Committee on the revision of M. C. B. Rules of Interchange has very carefully considered the 1906 Rules and are glad to report, as a general proposition, that they have proven very satisfactory. There are, however, a number of changes, corrections or additions, which your committee deems desirable to recommend which we feel are necessitated by the change in conditions and which will conform to the fundamental principles and true spirit of the Master Car Builders' Association.

The changes in prices for labor and material recommended were only decided upon after a thorough canvas of the situa-

tion; in fact, this feature prolonged the session of your committee an additional day, and the committee would ask your careful consideration of the changes hereinafter presented.

There are a few recommendations, made last year, which are again presented, with such additional data that will possibly enable the Arbitration Committee to further consider them.

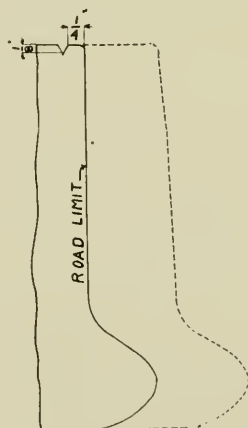
The explanations for the changes, additions or modifications in the various rules have been placed under the respective rules with a view of presenting the reasons for the changes in the most comprehensive manner.

CHANGES RECOMMENDED IN THE M. C. B. RULES OF INTERCHANGE.

Rule No. 12—Page No. 5.

Add: "*Steel or Steel Tired Wheels with Tread or Tire Thinner than shown in Figure 4-B.*"

As it is necessary from a safety standpoint to have some definite limits to which inspectors and shop men should work in condemning steel or steel tired wheels, your committee feels it essential to make provision for the same in the Rules of Interchange. As is well known, the difference in construction of rolled steel wheels and tires of steel tired wheels require dif-



ROAD LIMIT FOR STEEL AND
STEEL TIRED WHEELS

ferent thicknesses of tread. The best manner of determining this, is to establish a limit groove on the rim of the rolled steel wheel or tire and fix the condemning or road limit $\frac{1}{4}$ " above the same, so that inspectors can tell at a glance when a wheel has been worn down to the safe limit, otherwise it would be necessary to furnish each inspector or shop man handling this work with a table for the different makes of wheels or tires. Your committee would call attention to the fact that the thickness of tire is shown in the passenger rules, but we believe the limit groove shown in M. C. B. Recommended Practice, Sheet "A," is preferable for the reasons above stated.

Rule No. 21—Page 11—Fig. 6.

Omit the words: "*For wheels cast after August 31st, 1894.*"

As all wheels are to be gauged and mounted as shown in Figure 6, the words: "*For wheels cast after August 31st, 1894,*" are superfluous and should be omitted.

Rule No. 28—Page No. 13.

Add the words: "*Or bolts*" at the end of this rule.

Your committee believes that this addition is essential in order to make the rule read more clearly. As this rule does not specify the word "*bolts*" in the last clause, it has resulted in some railroad companies billing the owner for the journal box bolts, and as it was not the intention of the rule to permit this, we believe that the addition of the words "*or bolts*" at the end of this rule will avoid further contention.

Rule No. 28—Page No. 13.

Add additional rule after Rule No. 28, reading as follows: "*Cars with steel or steel tired wheels and so stenciled, if found with cast iron wheels, (delivering company responsible).*"

It is thought that the above provision should be made in the Rules of Interchange, in order to protect the owner who has applied steel or steel tired wheels to a car.

Rule No. 32—Page No. 13.

Omit the words: "*Or torn*" in first line and add sentence at end of paragraph, as follows: "*Torn air brake hose under all conditions.*"

Your committee feels that torn air brake hose should be a delivering company's responsibility under all conditions, in other words, where air hose are allowed to pull apart when the car couplers are separated, it results in the tearing of the air brake hose. While the hose couplings are supposed to be automatic in parting when car couplers are separated, the fact remains that unless the hose couplers are parted before the car couplings are separated, it often results in the hose being torn off. In other cases, where the hose are not actually torn, the inner tube is often ruptured, or pipe fittings strained to such an extent that it seriously effects the brake operation. These troubles are so prominent that some railroad companies have issued positive instructions and have gone to the expense of placing men in the yards to uncouple the hose before separating the cars. As this has been found such a serious matter from an air brake operation standpoint, your committee feels that the rule should be so changed as to place the responsibility of torn air brake hose on the delivering company under all conditions.

Rule No. 34—Page No. 11.

Omit the words: "*Or air brake pipes, but no air brakes.*"

Rule No. 36 provides that on and after September 1st, 1907, all cars offered in interchange, must be equipped with air brakes, which makes the portion of Rule No. 34 above referred to obsolete.

Add to Rule No. 34: "*Or Steam Pipes.*"

Your committee recommends that steam pipes be included in this rule with air-signal pipes, inasmuch as there are a large number of freight cars equipped with steam pipes, hose and couplings, as well as air-signal pipes, hose and couplings, in order to enable them being run in passenger trains as well as protecting the lading inside the car in extreme weather. As it becomes necessary to maintain these steam pipes, hose and couplings, to meet the demands of the service, your committee feels that the owner should be protected when he so equips the car and stencils same.

Rule No. 44—Page No. 15.

Add to the end of this rule: "*Or cars equipped with 5"x5", or 5"x7" shank standard M. C. B. coupler and so stenciled being*

found with couplers with shanks other than those standard to the car."

A large number of roads are using the 5"x7" shank standard M. C. B. Coupler on the heavier equipment. When these are replaced with 5"x5" shank couplers, they interfere with the proper mating of couplers in road service on account of too much side play, which is aside from the question of the lesser strength. For these reasons, your committee believes it essential that provision should be made in the Rules of Interchange.

Heading: Combination of Defects—Page No. 16.

Change the present heading to read: "*Combination of defects, which denote unfair usage if occurring at the same end of car.*"

Your committee recommends the omission of the words: "*If caused at one and the same time*" from this heading, for the reason that a delivering company cannot be excused from the responsibility if two parts entering into the combination of defects are broken, irrespective as to whether one part has been broken for sometime, or is defective, and the other part entering into the combination is a fresh break.

Rule No. 48—Page No. 16.

Omit the words: "*Coupler Stop.*"

Inasmuch as some of the coupler stops on our older equipment are too weak to withstand the service placed upon them and that a large number are running which are broken, resulting in damage to the other parts of the draft arrangement, and inasmuch as it is a difficult matter to determine whether these stops are in a defective condition or not, from the ordinary inspection, your committee feels that coupler stops should be eliminated from the combination defects. This opinion is further strengthened by the fact that where stops of proper design and strength have been applied to the cars, these failures do not occur. The breakage of coupler stops directly affects the damage to other parts of the car and with a view of bettering this vital part of the equipment, your committee strongly recommends that the expense of these failures be placed on the owners, which can best be done by eliminating the coupler stops from the combination defects.

Rule No. 50—Page No. 16.

Omit the words: "*Coupler Stop.*"

The above recommendation follows for the reasons given under Rule No. 48.

Rule No. 53—Page No. 16.

Omit the words: "*Coupler Stop.*"

The above recommendation follows for the reasons given under Rule No. 48.

Rule No. 56—Page No. 17.

In the fourth paragraph under Rule No. 56, add the word "*not*" before the word "*damaged*" in second line.

Couplers and attachments missing from cars are usually the result of weak or broken draft stops. As these attachments are generally found in good condition and as it is practically impossible to trace up each case before making the repairs to the cars from which such attachments are missing, your committee after very carefully considering same, feels that the matter should be brought to the attention of the Arbitration Committee, with a view of assuming that such parts are in good condition, and, therefore, should not enter into combination of defects.

Rule No. 57—Page No. 17.

At the end of this paragraph add: "*Except as provided for in Rule No. 125.*"

Your committee would again suggest to the Arbitration Committee that they consider this addition to the rule. There seems to be a constant contention in regard to the amount of repairs which a railroad company is permitted to make to a car and we feel that if the proposed addition is made to this rule, that it will clear up the situation. We, therefore, ask for further consideration.

Rule No. 61—Page No. 18.

Omit: "*Couplers of the vertical plane type other than M. C. B. replaced with M. C. B. standard, the expense of alteration thus necessitated shall be chargeable to car owners.*"

As all of the cars have been equipped with M. C. B. couplers, this portion of the rule has become obsolete.

Add new paragraph to Rule No. 61, as follows: "*All new couplers and knuckles cast after September 1st, 1907, must have the 'name' legibly cast upon them, as well as 'M. C. B.' and must be made in accordance with M. C. B. specifications. Couplers applied to foreign cars shall be considered wrong repairs unless they are made in accordance with M. C. B. specifications and are so labeled.*"

Some couplers of weak design which do not meet the M. C. B. specifications, but simply conform to the standard contour lines, are being applied to cars in repairs. In order to obviate this and obtain the benefit of the Coupler Committee's very efficient work, we would strongly recommend to the Arbitration Committee that the above addition to the rule be inserted, which will make it obligatory to follow the standards of the Association on all new couplers purchased and will insure couplers of the proper design being applied to the cars when repairs are made. This will in no way work a hardship to any of us and will improve this important part of the equipment.

Rule No. 65—Page No. 22.

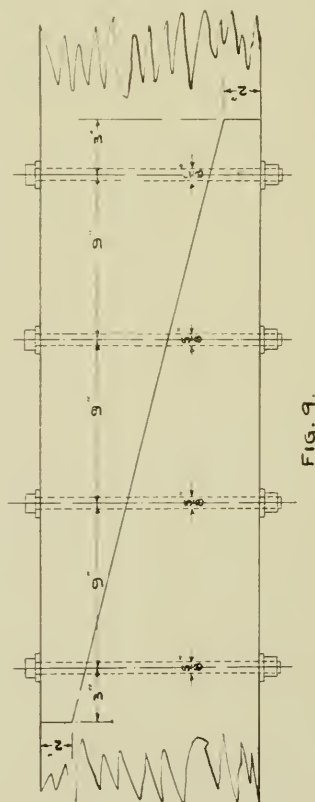
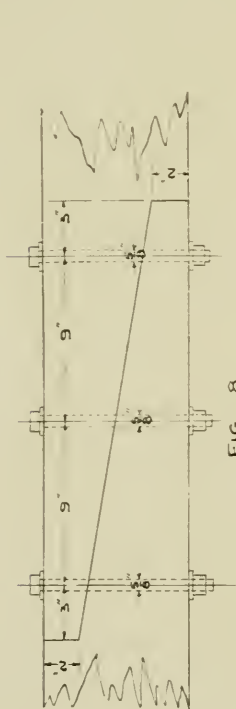
It is recommended that the following, in regard to splicing of two center sills at the same end of car, be referred to a Committee of the M. C. B. Association, with the view that such Committee will carefully consider the matter and make recommendations in regard to the location and manner of splicing two center sills at the same end of the car, if it is feasible to do this without impairing the strength of the car.

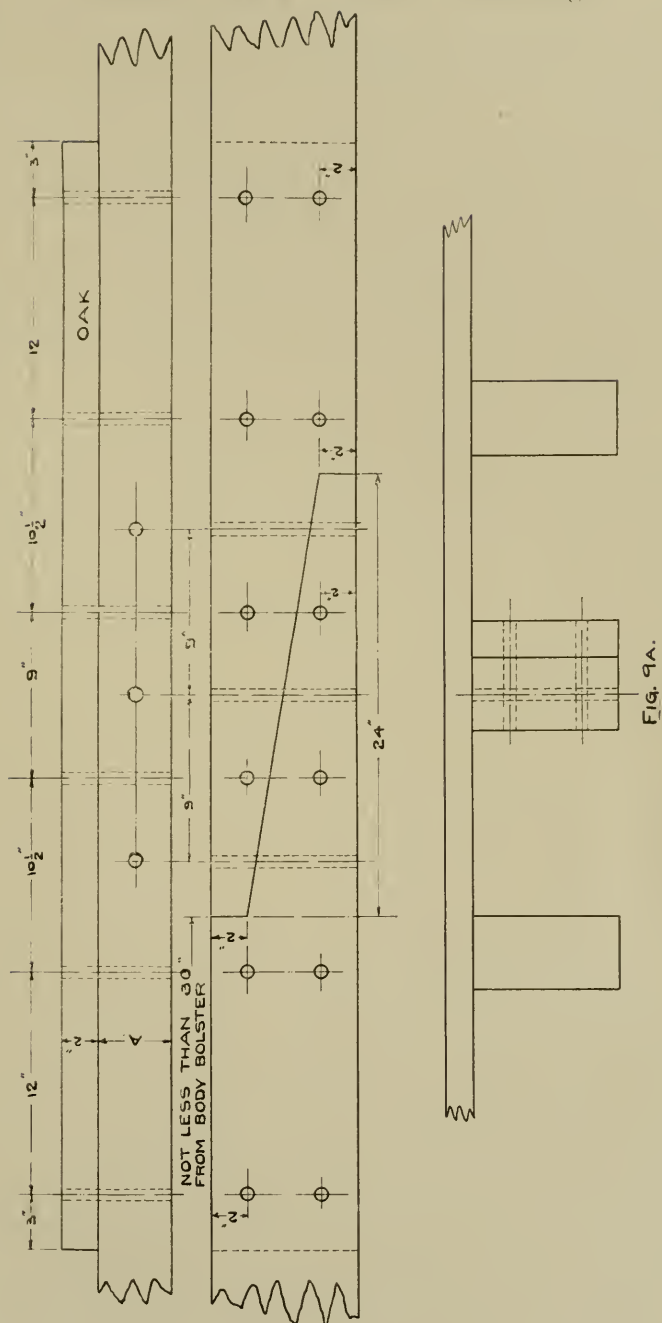
It is recommended that the splices shown in the following diagrams be substituted for those shown in the M. C. B. Rules of Interchange under Figs. 8, 9, and 9-A.

Change this paragraph to read: "*Splice may be located at either side of body bolster, but the nearest point of any splice must not be within 12" of same, excepting center sills which must be spliced between body bolster and cross-tie timbers and not within 30" of either. The splicing of two adjacent sills, EXCEPTING CENTER SILLS, at the same end of car, or the splicing of any sill between cross-tie timbers, will not be allowed. BOTH CENTER SILLS MAY BE SPICED AT SAME END OF CAR.*"

As it is commonly found that both center sills are broken at the same end of car, very little benefit is derived from splic-

ing one center sill, and as it has been found in practice that it is entirely safe and practicable to splice both sills at the same end of car, your committee would recommend for consideration the above change in the rules, which will permit the splicing of two center sills at the same end of car. This is a very important matter from the fact that it is extremely difficult to obtain the proper grade of yellow pine lumber in sufficient quantities to supply the demands and aside from the high cost of same, the supply is not equal to the demand; for which reasons, your committee would strongly urge that the splicing of both center sills at the same end of car be permitted, otherwise, the rule to remain as at present, in that adjacent sills at the same end of car must not be spliced, which will take care of the strength of car across the sills between body bolster and cross-tie timbers.





Figures 8, 9 and 9-A should be revised as shown on sketches attached.

It has been found that sills which have been spliced according to Figures 8, 9 and 9-A shown in the Rules of Interchange, have split longitudinally from the bevelled sharp corner formed by the $1\frac{1}{4}$ " shoulder and the sketches herewith submitted show splice with square shoulders which would avoid this trouble. Your committee, therefore, strongly recommends the consideration of the substitution of the sketches presented for the present method of splicing shown in the Interchange Rules.

Rule No. 72—Page No. 24.

Add after the word "Car" in the third line: "*Or if the light weight is obliterated.*"

There are a large number of steel cars running and some wooden cars on which the stenciling of the light weight is entirely obliterated; in some cases due to the age of the paint and in other instances the result of the paint scaling off. As it is absolutely necessary to have the light weight stenciled on the cars, as provided for in Rule No. 23, your committee suggests that the above addition be inserted in the rule, which will permit a railroad company to weigh and stencil such cars on which the light weight is obliterated.

Rule No. 75—Page No. 25.

Change to read: "*When two or more cars, carrying twin and triple shipments of long lading, chained together with switch chains and couplers blocked out with metal spacing blocks are delivered at an interchange point, the receiving road shall deliver to the delivering road at the time, an equivalent number of switch chains and metal spacing blocks of the same size as the chains and blocks used on the cars delivered, or in lieu thereof, furnish a defect card for such chains and metal spacing blocks.*"

The chaining of cars offered in interchange is now confined to cars carrying twin and triple shipments of long lading and where such cars are equipped with chains, it is necessary to block couplers apart by inserting hardwood or metal blocks (latter preferred), as provided for in the recommended practice, Rule No. 26, Rules for Loading Long Materials. As both

the temporary safety chains and metal spacing blocks are recommended practice and the same absolutely necessary to handle the load safely to destination, it is the opinion of your committee, that metal spacing blocks should be inserted in the rule with the safety chains in order to protect the railroad company applying same and facilitate the movement of the car through the interchange point.

Rule No. 77—Page No. 28.

Change: *"In case of knuckles, they must state whether open or closed knuckles are removed and applied,"* to: *"In case of knuckles they must state whether open or closed knuckles are removed."*

It is recommended to omit the words *"and applied,"* inasmuch as an open knuckle cannot under Rule No. 59 of Interchange Code, be applied to a car, as solid knuckles only are M. C. B. standard.

Rule No. 82—Page No. 29.

Add at the end of this rule: *"Except when so damaged that car owner elects to destroy car, in which case, bill may be rendered on defect cards by owner on destruction of car."*

When equipment reaches home road which has been badly damaged and the damage covered by defect cards, the owner may elect to destroy the car rather than make the repairs. The above provision is made in this rule to enable the car owner to bill on the defect cards when he destroys the car.

Rule No. 89—Page No. 35.

Change table for 33" cast iron wheel to read as follows:

	SECOND-		
	NEW.	HAND.	SCRAP.
One 33" cast iron wheel, 700 lbs. and over.....	\$10.00	\$7.50	\$5.50
One 33" cast iron wheel, under 700 lbs.	8.50	6.75	4.50

On account of the decided difference in price between heavy and light wheel, your committee recommends that a division be made between the wheels on a weight basis. We are all aware that the heavy wheel costs decidedly more than the lighter pattern and in order to adjust the price to more equitably re-

imburse the road making the change in the wheels, your committee recommends the above.

Rule No. 94—Page No. 36.

On account of the decided increase in the values of material, your committee after a careful canvass of the situation and comparison with existing market values, recommends the following changes in the prices of material to more equitably cover the cost of making repairs.

A number of other changes are also suggested, the reasons for which are give nunder the respective items.

Air Brake Hose. Omit reference to size.

Since the 1¼" size given is simply nominal and as air brake hose must be furnished in accordance with M. C. B. standard specifications the size should be omitted.

Omit air brake material prices with the exception of "*Air Brake Hose*."

The present rules do not cover the 10"x12" air brake equipment now commonly used on the heavier equipment and as air brake material in general comes under the head of "*Manufactured Articles*," we would recommend that the same be eliminated from the rules rather than including the additions, the present list being incomplete.

Castings, rough iron per pound, increase from 1¾ cents to 2 cents, credit to remain the same.

Castings, rough steel per pound, increase from 4½ cents to 5 cents, credit to remain the same.

Coupling, dummy, omit from rules inasmuch as the same are obsolete for freight equipment and not used.

Coupler, M. C. B. complete, new, malleable iron .5"x5" shank, charge \$7.25 to be omitted from the rules.

The M. C. B. standard specifications provide that couplers be made of steel and all couplers applied to foreign cars must be M. C. B. standard and in accordance with specifications. Malleable iron couplers do not comply with such specifications. By retaining the price in the Interchange Rules it sanctions the use of same, which is contrary to the provisions of Rule No. 59.

Couplers, M. C. B. standard complete, new, steel, 5"x5" shank, advance price from \$8.25 to \$8.75.

Coupler, M. C. B. complete, new, malleable iron, 5"x7" shank, omit from rules for the reasons stated above.

Coupler, M. C. B. standard complete, new, steel, 5"x7" shank, advance price from \$9.00 to \$10.00.

Coupler body, one, new, malleable iron, 5"x5" shank, omit charge of \$5.25 from the rules, the credit to remain as at present, for the reasons above stated.

Coupler body, one, M. C. B. Standard, new, steel, 5"x5" shank, advance price from \$6.25 to \$6.50.

Coupler body, one, new, malleable iron, 5"x7" shank, omit charge of \$6.00, the credit to remain as at present, for the reasons above stated.

Coupler body, one M. C. B. standard, new, steel, 5"x7" shank, advance charge from \$7.00 to \$7.75, the credit to remain as at present.

Coupler knuckle, one, new, open, omit charge of \$1.70. credit to remain the same as at present, for the reasons above stated.

Coupler knuckle, one M. C. B. standard, new, solid, increase charge from \$1.85 to \$2.00, credit to remain as at present.

Add: "*Coupler Locks complete*," charge 47 cents, credit 7 cents.

Other individual malleable, wrought or steel parts, per pound, advance from 3½ cents to 4 cents.

Door, for end of box or stock car, wooden, each, applied, no credit for scrap, advance charge from \$1.75 to \$2.00.

Door, for side of box or stock car, wooden, each, applied, no credit for scrap, advance charge from \$3.50 to \$4.00.

Door, for side of box or stock car, ventilated (wooden frame with iron rods), each, applied, no credit for scrap, advance charge from \$5.00 to \$5.50.

Journal bearings, brass or bronze, lined or unlined, per pound, applied, increase charge from 16 cents to 18 cents and increase credit from 11 cents to 12 cents.

Labor, per hour, increase from 20 cents to 25 cents per hour.

Lumber, yellow, white and Norway pine, poplar, oak, hickory and elm, dressed and framed per foot, B. M., required to make the part, increase charge from $3\frac{1}{4}$ cents to $3\frac{1}{2}$ cents.

Add: Steel, sheet, per pound, charge $2\frac{1}{2}$ cents, credit $\frac{1}{2}$ cent.

Rule No. 97—Page No. 40.

Change the word "*Channels*" to "*Structural Steel*."

At the time this rule was framed, channels were used in spring planks. As different sections of rolled material are now being used, we suggest the above change so as to cover all structural steel.

Rule No. 98—Page No. 40.

Change "100 cents" to "*Ten Dollars*."

There are very few repairs made to cars which do not aggregate more than 100 cents, for which reason we believe that no bill should be returned for correction on account of error for less than \$10.00. Very often small errors of this kind involve the holding up of bills of large amounts and we believe the situation would be greatly improved if the amount of error would be increased from 100 cents to ten dollars, for which bills may be returned for correction.

Rule No. 105—Page No. 42.

Altering height of one end of one car, net, increase charge from \$1.00 to \$1.25.

The above is recommended to cover the advanced cost of doing this work.

Rule No. 106—Page No. 42.

In addition to the change in the price of labor from 20 cents to 25 cents per hour, your committee would also recommend the following changes in the number of hours for certain items in order that the number of hours shown opposite these respective items will more nearly approximate the actual hours of labor required to perform the work:

American continuous draft rods, one rod, welding, advance from one to two hours.

Carrier iron bolts: The following changes are recommended inasmuch as it is usually found that two bolts are broken and the present time of two hours allowed for one and two bolts applied is excessive.

We would therefore recommend changing the items of Carrier Iron Bolts to the following:

Carrier iron bolts, one or two, at same end of car, renewed, one hour.

Carrier iron bolts, three or all, at one end of car, renewed, two hours.

Carrier iron bolts, renewed when coupler is changed, one or all, one hour.

Change "*Coupler with pocket attachments*" to read as follows: "*Coupler, with pocket attachments, single spring, one or more follower plates, one or two coupler stops, coupler pocket, coupler pocket rivets, renewing or replacing any or all, at same end of car at same time, three hours.*"

Coupler, with pocket attachments, twin spring, tandem spring or friction gear, one or more follower plates, one or two coupler stops, coupler pocket, coupler pocket rivets, renewing or replacing, any or all at same end of car, at same time, five hours.

The following change in the hours of labor, applying draft timbers is recommended: "*Draft timber extending to body bolster, one replaced, 7 hours.*"

Draft timber extending to body bolster, one replaced, when center sill has been replaced, 2 hours.

Draft timber extending to body bolster, two, on same end, replaced, 10 hours; refrigerator cars, 11 hours.

Draft timber, extending beyond body bolster, one replaced, 9 hours.

Draft timber, extending beyond body bolster, one replaced, when center still has been replaced, three hours.

Draft timbers extending beyond body bolster, two on same end, replaced, 13 hours; refrigerator cars, 14 hours.

Omit: "*Draft timber bolts, complete, at one end of car,*

replacing, 3 hours," as the same is covered by "Draft timber bolts, four or more, at one end of car, replacing, 3 hours."

Siding, removed and replaced, per lineal foot, advance from 10 cents to 12½ cents.

Siding, removed and replaced, where nails are set and holes puttied, advance from 12 cents to 15 cents.

Sills: Advance labor charge for one center sill, spliced, for ordinary cars, from 16 hours to 20 hours; refrigerator cars, from 20 hours to 24 hours.

"When necessary to remove load to replace body center plate, bolt or bolts, CROSS-TIE TIMBER, one or two draft timbers, or draft timber bolts, at one end of car, three hours."

Cross-tie timber has been added to the above item and the charge for labor advanced from two to three hours.

Repairs to Steel Cars.

"Straightening or repairing parts in place in damaged car; also any parts that require straightening, repairing or renewing, not included on rivet basis," advance from 20 cents to 25 cents per hour.

Rule No. 113—Page No. 54.

Change to read: *"The settlement prices of new eight-wheel cars shall be as follows, with an addition of \$27.50 for each car equipped with 8" schedule of air brakes and \$35.00 for 10" schedule of air brakes,"* the remainder of the rule to remain as at present.

The price for the 10" schedule of air brakes is added to this rule as the same is used under the heavier classes of equipment.

Rule No. 113—Page No. 54.

Bodies.

Wood.

That the settlement price for box cars, wooden bodies, be increased 10 per cent.

That the settlement price for gondola cars, 30 tons capacity and over, wooden bodies, be increased 10 per cent.

The above recommendations are made to cover the increased cost of building wooden cars.

Rule No. 113—Page No. 56.

Composite Cars.

That all box, flat and gondola cars with metal underframe and wooden body be known hereafter under a separate heading, as "*Composite Cars.*"

The settlement price for Composite Cars to be advanced 10 per cent.

The above recommendation is to cover the increased cost of building these cars.

Rule No. 113—Page No. 56.

Steel Cars.

The settlement price of all steel car bodies to be on the basis of $3\frac{1}{2}$ cents per pound for the weight of the body when new, instead of a fixed sum according to the capacity and length of car.

It would seem more equitable, to your committee, to base the settlement price of all steel car bodies on a fixed rate per pound rather than on the capacity and length of the car on account of the wide variation in the weights of all steel cars of the same capacity and length. The cost price of all steel body car is dependent almost entirely upon the weight, for which reason your committee feels that the above change in the rule should be made.

Rule No. 113—Page No. 57.

Trucks.

In the settlement price for trucks, it is recommended that \$30.00 be added to the present price given in the Interchange Rules, for "*all metal trucks, with cast iron wheels, of 60,000 pounds capacity or over.*"

The above recommendation is made with a view of covering the advanced cost of building trucks of this type.

Trucks with steel or steel tired wheels should have an additional allowance of \$56.00 per truck, \$112.00 per car.

The above recommendation is to cover the increased cost

of trucks equipped with steel or steel tired wheels over and above the figure for trucks equipped with cast iron wheels.

Rule No. 113—Page No. 57.

Four-Wheel Cars.

The price given for four-wheel cars should be dropped from the rules, inasmuch as this type of car has become obsolete.

Rule No. 114—Page No. 58.

Change Rule No. 114 to read as follows: "*In the case of wooden cars, the depreciation due to age shall be estimated at 6 per cent per annum upon the yearly depreciated value of the bodies. In the case of all steel cars and composite cars, the depreciation shall be 4 per cent per annum for the bodies of all steel cars; for bodies of composite cars the depreciation shall be at the rate of 5 per cent per annum. The depreciation on the value of all metal trucks of 60,000 pounds capacity and over shall be 4 per cent per annum and for all other trucks 6 per cent per annum. Allowance for depreciation shall in no case exceed 60 per cent of the value new. The amount for air brakes shall not be subject to any depreciation.*"

The above recommendation involves the changing of the depreciation on the bodies of all steel cars from 5 per cent to 4 per cent per annum, and bodies of composite cars from 6 per cent to 5 per cent per annum. The trucks have been divided into all metal of 60,000 pounds capacity and over and all other trucks, the former to be depreciated at the rate of 4 per cent per annum and the latter to remain as at present. This recommendation is made with a view of more consistently depreciating the value of the steel and composite car bodies and all metal trucks based on their longer life.

Rule No. 125—Page No. 61.

We desire to call attention to the unnecessarily long haulage of cars in order to get them to the home road over the same route which the car passed to the point where it became unserviceable. At present cars are often hauled empty a great distance in order to get them home by the same route they were delivered, which frequently causes additional damage while en route and seriously delays the car.

As this is a traffic question, it is recommended that same be referred to the American Railway Association with the suggestion that it be turned over to the Committee on "Efficiency of Car Service."

Index.

Your committee would recommend for consideration the appointment of a special committee of the Master Car Builders' Association to formulate a suitable index to the Rules of Interchange.

It is believed that a suitable index would greatly assist car inspectors to acquire a quicker and more thorough knowledge of the Interchange rules and facilitate the handling of their business.

Respectfully submitted,

R. L. Kleine, Chairman.	S. M. Hindman.
W. J. Buchanan.	W. J. Knox.
G. E. Carson.	A. La Mar.
S. A. Cromwell.	F. J. Reeve.
G. H. Davis.	J. B. Swann.
G. N. Dow.	H. W. Watts.

PRESIDENT: The report of our Standing Committee is surely a credit to our Club, and I think it would be in order for some one to make a motion that the recommendations of the Committee, as corrected, be approved.

ON MOTION of Mr. Dyer, seconded by Mr. Barnsley, the report, with the recommendations, as corrected, was adopted and a vote of thanks is extended to the Committee for their very able and efficient services.

MR. WATTS: I noticed a considerable absence of discussion. That may be considered as a compliment to the Committee, but we would consider it a greater compliment if you had showed that you had carefully considered the report by discussing it. I believe one reason for this is the fact that most of the members did not get their advance sheets until today, and some had not got them when they left their offices. And I would suggest that an effort be made to get the advance sheets of this report, as well as any other advance sheets, out at least two days before the meeting.

And one other point, suggested by Mr. Dyer. I speak for every member of the Committee when I say we would be glad to receive suggestions during the year regarding any changes that may be desired. This would be in line with the practice of the M. C. B. A. And I therefore move that in January of each year the Secretary send to each member a circular letter calling attention to the fact that your Committee is about to meet and calling for suggestions. It would, I think, increase the usefulness of your Committee.

The motion, being duly seconded, was carried.

SECRETARY CONWAY announced the death of D. L. Macomber, the Pittsburgh representative of the firm of Pratt & Whitney, and suggested the appointment of a committee to draft suitable resolutions.

The President appointed as such committee Messrs. D. M. Howe, D. C. Noble and J. B. Bellows.

ON MOTION, Adjourned.

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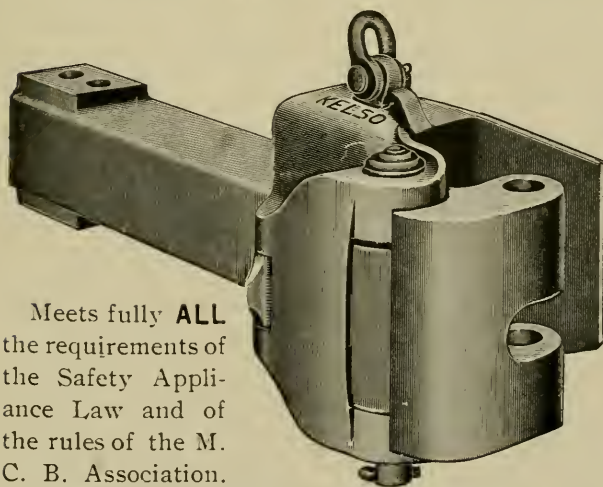
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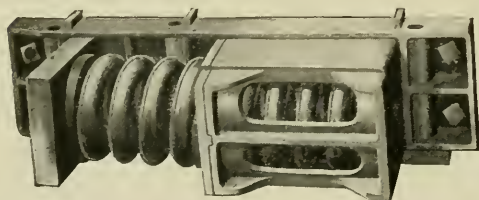
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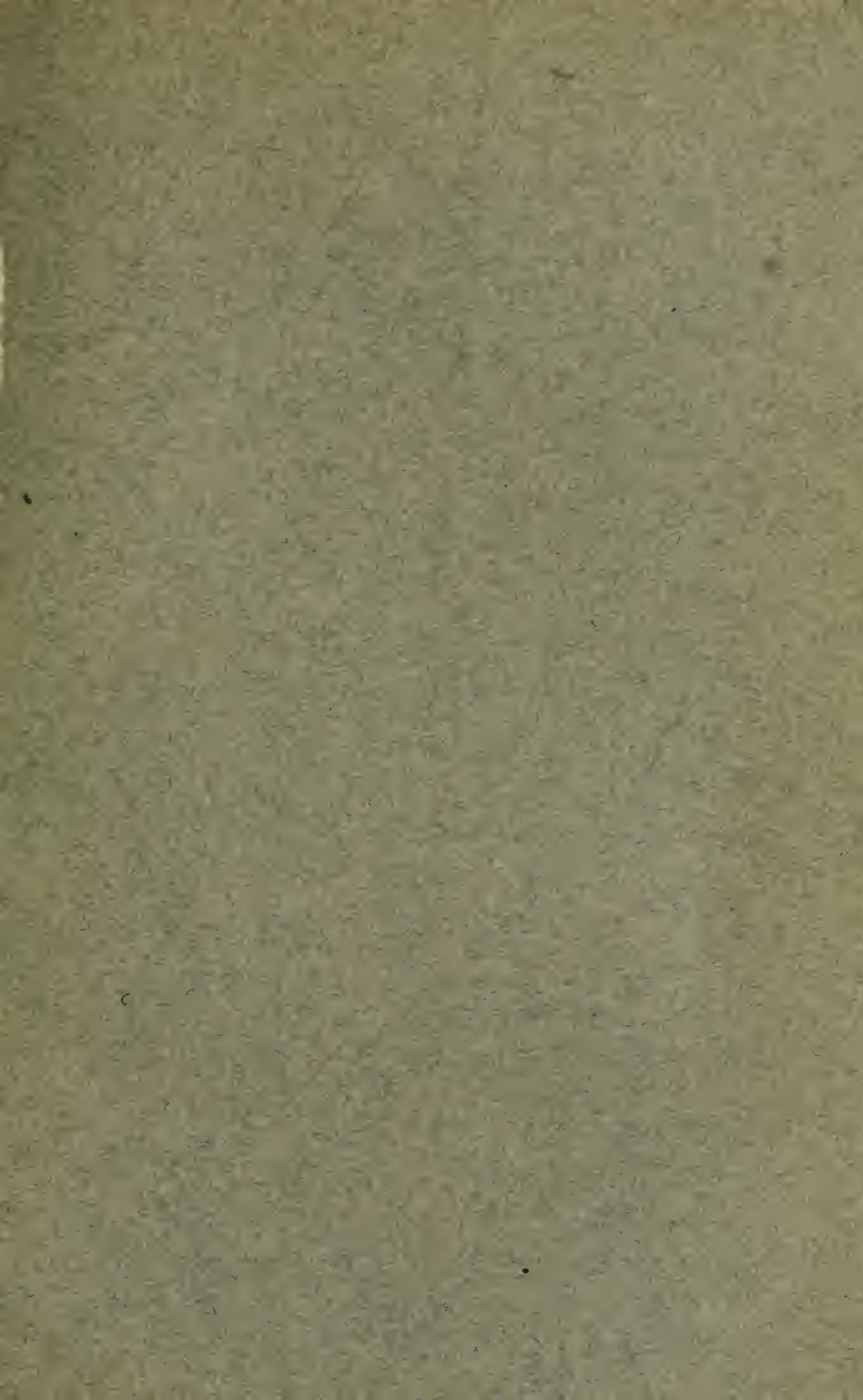
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






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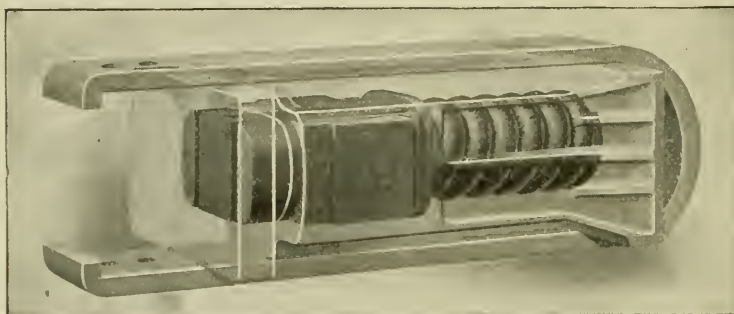
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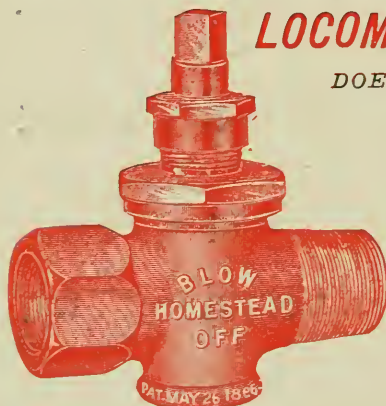
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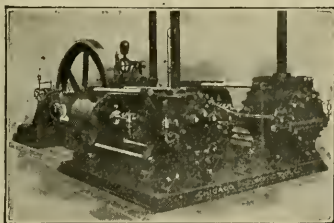
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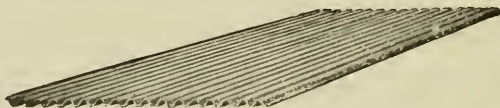
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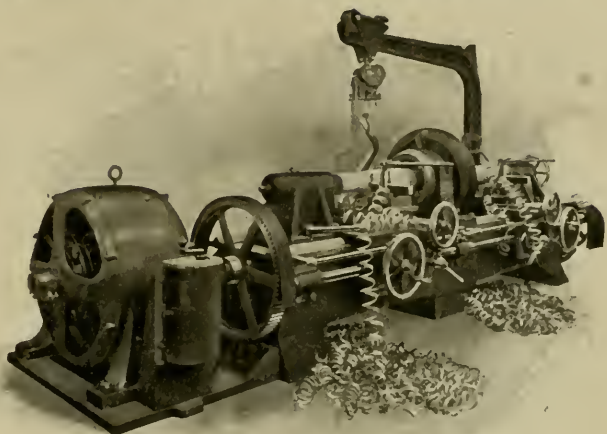
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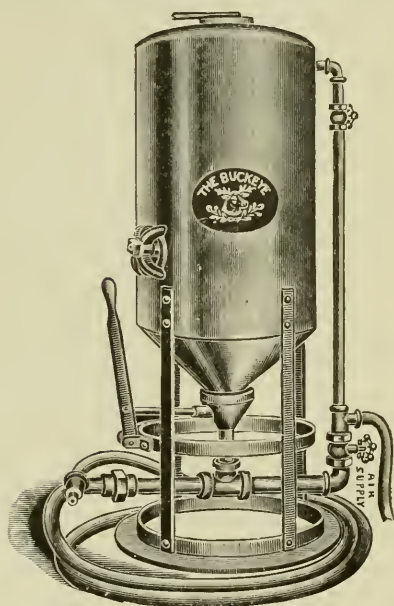


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ORGANIZED OCTOBER 18, 1901.

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No. 7.

Pittsburgh, Pa., May 24, 1907.

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J. D. Conway, Secretary, General Offices P. & L. E. R. R., Pittsburgh, Pa.

Meetings held fourth Friday each month, except June, July and August.

**PROCEEDINGS OF MEETING,
MAY 24th, 1907.**

The meeting was called to order at the Monongahela House, Pittsburgh, Pa., at eight o'clock, P. M., by Vice President Mr. George T. Barnsley in the absence of President Stark.

The following gentlemen registered:

MEMBERS.

Anderson, J. B.	Lobez, P. L.
Ault, C. B.	Long, R. M.
Baker, J. H.	Lortz, E. A.
Bollinger, C., Jr.	Lynn, S.
Barnsley, Geo. T.	Maguire, W. E.
Bigham, C. G.	Mawhinney, Wm. J.
Blest, M. C.	Murphy, W. J.
Brand, Thos.	McGaughey, C. L.
Brown, Geo. P.	McIlwain, J. D.
Buchanan, W. J.	McNulty, F. M.
Burkhard, A. A.	Oates, Geo. M.
Conway, J. D.	Peach, W. M.
Chittenden, A. D.	Plunkett, Thos.
Coulter, A. F.	Porter, H. V.
Cox, P. L.	Redding, D. J.
Curtis, H. C.	Ryan, Wm. F.
Cassidy, D. E.	Taylor, H. G.
Fischer, Charles L.	Townsend, T. E.
Gies, Geo. E.	Trinler, Chas. M.
Hall, C. W.	Tucker, John L.
Haynes, J. E.	Turner, Walter V.
Howe, D. M.	Shaler, Fred J.
Hunter, H. S.	Scheck, H. G.
Jacob, W. W.	Shannon, Chas.
Kennedy, Jas.	Shuck, Wm. C.
Kessler, D. D.	Smith, M. A.
Kinter, D. H.	Squire, Willis C.
Kissinger, C. F.	Stucki, A.
Knickerbocker, A. C.	Warne, J. C.
Knight, E. A.	Warnock, H. R.

Yohe, J. K.

VISITORS.

Alfree, Jas. B.	Cole, Jewett.
Alleman, C. W.	Cramer, Edw.
Augur, Robt. C.	Dildein, E. E.
Battenhouse, John.	Donovan, H. A.
Congdon, Will. J.	Dorman, P. H.

Hawkins, M. E.	Porter, P. P.
Hilberry, H. H.	Richardson, E. F.
Jack, N. W.	Rodman, Thos.
Jackson, C. A.	Shipley, B.
Mackert, A. A.	Thomas, J. W.
Morton, Geo. H.	Thompson, B. W.
Pollard, E. C.	Volguarts, Fred.
Porter, M. R.	Wright, John B.

The Secretary read the following proposals for membership :

- A. A. Burkhart, F. C. R., P. & L. E. R. R. Co., Glassport, Pa.
 S. K. Dickerson, A. S. M. P., L. S. & M. S. Ry. Co., Cleveland, Ohio.
 H. A. Donovan, Car Department, Aliquippa & Southern Ry. Co., Woodlawn, Pa.
 W. H. Falkenstein, Superintendent, Railway Steel Spring Co., 20th and Liberty Sts., Pittsburgh, Pa.
 J. H. Gano, Superintendent, Aliquippa & Southern Ry. Co., 37 Marion St., Pittsburgh, Pa.
 M. J. Hepburn, Motive Power Clerk, W. P. Div., P. R. R. Co., Union Station, Pittsburgh, Pa.
 E. F. Mason, Special Apprentice, P. R. R. Co., Altoona, Pa.
 O. R. Prosser, Secretary, Wampum Crushed Limestone Co., New Castle, Pa.
 Robert Reilly, Chief Clerk to G. S. M. P., Penna. Lines, 31 Madison Ave., Bellevue, Pa.

VICE-PRESIDENT: These names will be referred to the Executive Committee for approval.

Secretary Conway read the following telegram, announcing the death of Mr. W. J. Martin, a member of this Club :

THE PITTSBURG, SHAWMUT & NORTHERN R. R. Co.

ST. MARYS, PA., April 30, 1907.

Mr. J. D. Conway,
 Sec. Railway Club of Pittsburgh.
 Pittsburgh, Pa.

Dear Sir:—Mr. W. J. Martin, who was a member of the Railway Club of Pittsburgh, died at 7:45 A. M. this date.

Yours truly,

R. A. BILLINGHAM,
 Superintendent Motive Power.

MR. C. B. AULT: I was requested by Mr. Kerr, one of the members of the Club, who could not be here to-night, to bring up a matter that I think will be of considerable importance to the members and also to the citizens of Pittsburgh and this vicinity. It is, that we make a bid for the M. C. B. and Master Mechanics' Conventions for next year. One of the arguments that I wish to bring up is that this is really the center for all materials and everything that goes into a railroad and the construction and maintenance of the same. We have large interests here, and they would no doubt be of interest to the members of the M. C. B. and M. M. We have the steel manufacturers and the raw material and we have the finished product from the initial stage right up. We have the Exposition Building, that would be large enough to accommodate all the delegates and would be sufficiently large for a convention hall. The hotels, I believe, are ample to accommodate everybody that would come here; I believe they would be ample if the matter were taken up in time, say six months before, and rooms engaged. We have the Carnegie Institute, the Technical Schools; we have locomotive works here, we have large modern railway car shops, we have one of the large air brake manufacturing institutions in this country located here, we have electrical manufacturing plants which are of great interest to railway companies at this time. And I believe we have a good argument on which to base a bid for it. And if the matter were taken before the Chamber of Commerce, the Mayor, and other influential bodies, I believe we could go down to Atlantic City with a good argument. It is merely a suggestion that I make, and I would be pleased to have this meeting consider it.

VICE-PRESIDENT: Do any of the members feel like taking up this subject that Mr. Ault suggests, or have you anything to say regarding it? Pittsburgh is destined, I believe, to become a convention city, and if this matter is taken up it will certainly help the good cause along.

MR. D. M. HOWE: I certainly heartily coincide with every word the gentleman has just spoken on behalf of having the Master Car Builders and the Master Mechanics' conventions meet here next year. But if there is any work to be done, it will have to be done quickly, as the convention meets in Atlantic

City the coming month; and to get the different bodies going, like the Chamber of Commerce, anything that is done will have to be done quickly. I am a member of the Chamber of Commerce, and I will be glad to do anything I can to help the matter along. What the gentleman has said has covered every point. The matter of hall and hotels is all I can see that might be a drawback. I think Exposition Hall would be sufficient, but whether the hotels would be able to take care of the conventions or not I do not know.

VICE-PRESIDENT: How large is the body?

SECRETARY: About 4,000.

MR. HOWE: That is one of the largest conventions held in the whole country. I was in Columbus at the Railway Convention last fall and they said they had nearly 4,000 there, and some of us were glad to sleep most any old place. And the hotel accommodations had been taken up six months before the convention.

Another thing. I know something about the workings of those M. C. B. and M. M. committees which arrange for the place of holding the convention, and they generally act on the initiative this year of what they will do next year. So whatever is done has got to be done quickly. I would like to see the Pittsburgh Railway Club take the initial step in this matter.

VICE-PRESIDENT: Do you know how many people could be accommodated in the auditorium of Exposition Hall?

MR. HOWE: I think there would be no trouble about that. It will accommodate 5,000, I understand.

VICE-PRESIDENT: Carnegie Music Hall seats only 1800.

MR. HOWE: There are a great many exhibits, and that takes up a large space. It would take something like Exposition Hall to cover it.

VICE-PRESIDENT: I would suppose the Exposition Building could be fitted up to accommodate the convention if it were taken in time.

SECRETARY CONWAY: It may be a matter of information to the organization to know that the Chamber of Commerce of our city has already considered the question of getting the two conventions, the Master Car Builders and the Mas-

ter Mechanics, to meet at Pittsburgh. They have already secured the Exposition Hall, and they think that the Exposition buildings would meet all the requirements of the organizations, for the reason that they build booths ordinarily outside of the buildings proper, as at Saratoga, Manhattan Beach and Atlantic City, and on the Exposition grounds they could have outside exhibits and use Machinery Hall for the inside exhibits; and there is no question but the Exposition buildings and grounds would be ample to take care of the convention.

I think Mr. Howe has raised about the strongest objection that could be brought against securing the conventions for this city, and that is hotel accommodations. I had some talk with a representative of the Chamber of Commerce, as well as some railroad men, and it seems as though they had some concerted action as to getting the conventions to come to this city. They talked with me about how many there were at the conventions, and I wrote Mr. Taylor, secretary of the two organizations, for the information, and he said there were about 4,000 people. I think Pittsburgh could put forth about as strong arguments as to inducements to bring those two organizations here as Manhattan Beach. It goes without saying that Saratoga is the ideal place for such conventions. Atlantic City is all right so far as hotel accommodations are concerned, but outside of that they have nothing to show except the bathing, and it is a little early for that when the meetings are held. So I think Pittsburgh, as Mr. Ault has stated, could put forth some facts, if it were strongly backed up, as I think it would be by the Chamber of Commerce and the Exposition Society, and other organizations probably would be glad to join with us if it were brought to their attention, and I think it would be wise for us to take some definite action to-night. For instance, have this organization write to the secretary of the associations putting in our claims for the next meeting, and in addition to that it would be necessary that a Committee be appointed, preferably of those who are also members of these two associations, and it would be well to get our hotel people interested and have them there to tell what they can do. The Committee which decides on the place of the next convention will probably act in the latter part of the year. The M. C. B. A. and M. M. A. do not decide them-

selves at their open meetings; they appoint a committee which will decide that later.

MR. D. M. HOWE: I move that the Secretary be instructed to write to and confer with the committee of these two organizations relative to having their convention held in Pittsburgh; and also I would further move that there be a committee, the number of which to be determined by the Chair, appointed to act with the officials of this organization, as members ex officio of that committee. And I would suggest that the committee be composed of as many Master Mechanics and Master Car Builders as can possibly be found in our organization.

The motion being seconded by Mr. Ault, was carried.

VICE-PRESIDENT: I do not wish to force any suggestions on this Club, but it seems to me that it would be very proper for this committee to confer with the officers of the Chamber of Commerce, and also with the hotel men's organization with reference to hotel accommodations. Those are two essential features, to my mind.

If there is nothing further we will proceed to the next order of business, which is the paper on the Quick Service Triple Valve. This very interesting paper has been prepared by Mr. Blackall, and is to be read by Mr. Walter V. Turner, of the Westinghouse Company. I take great pleasure in announcing this fact, because Mr. Turner is an expert in the air brake business. He has spent years upon the subject and made a specialty of it, and thought over it during his sleeping moments as well as his waking ones I am inclined to think, and he will present the matter to you, interlining the text of the paper with his experience and his own suggestions. I take great pleasure in presenting Mr. Turner to the members of the Club.

The Westinghouse Air Brake Company.

Quick-Service Triple Valve.

MR. W. V. TURNER: Mr. President and Members of the Railway Club of Pittsburgh: Due to the absence of Mr. Blackall, who is out in Colorado, and, by the way, using the K Triple Valve in bringing trains down the mountains where

heretofore they have been bringing them down with hand brakes, I have been requested to read the paper before you tonight, which I assure you affords me great pleasure.

As this is a paper by a supply company, some of you may think that we give only such information as we care to disclose. I want to say, however, that we have tried to cover as much in this paper as the time would permit, and we are ready at any time to give any information or data to any member of the Pittsburg Railway Club who may desire it. Not only that, but I am prepared, and in fact would request you gentlemen to ask whatever questions you may desire on the subject, for I might read this paper and talk on the K. Triple Valve or other apparatus a very long time without touching the point you may be most concerned with or desire information on. So that I hope to get through in time that will permit of some questions being asked.

The triple valve which has been in service for so many years was originally designed for use on a maximum train of 50 cars. Since its inception the length of trains has gradually increased until, at present, it is not uncommon to have 100-car trains in regular service, and this number is sometimes as high as 120 and 130. It could not be expected that the valve designed to operate in conjunction with the shorter trains will give equally good results in such long trains, and this has been found to be the case.

Owing to the difference in the conditions to be met, the Westinghouse Air Brake Company has developed a triple valve which will not only give as good, but better results in a 100-car train than could formerly be obtained with the older type of triple valves on a 50-car train. This is known as the Quick-Service (Type K) triple valve and contains the Quick-Service, Uniform-Recharge and Retarded-Release features. The following is a description of the different features, and what the valve is designed to accomplish is outlined.

Full Release and Charging Position—Fig. 1 is a diagrammatic view of the triple valve in this position. Air from the brake pipe flows through passage E, cylinder cap *f*, and ports *g* to chamber *h*; thence through feed groove, *i*, now open, to cham-

ber R above the slide valve, which is always in free communication with the auxiliary reservoir. The feed groove *i* is of the same dimension as that of the old standard H-1 (F. 36) triple valve, which is designed to properly charge the auxiliary reservoir of an 8-inch brake cylinder, and prevent any appreciable amount of air from feeding back into the brake pipe from the auxiliary reservoir during an application. For this reason, the feed groove of the K-2 triple valve is made the same size as the K-1, so that it is necessary in the K-2 triple to increase the charg-

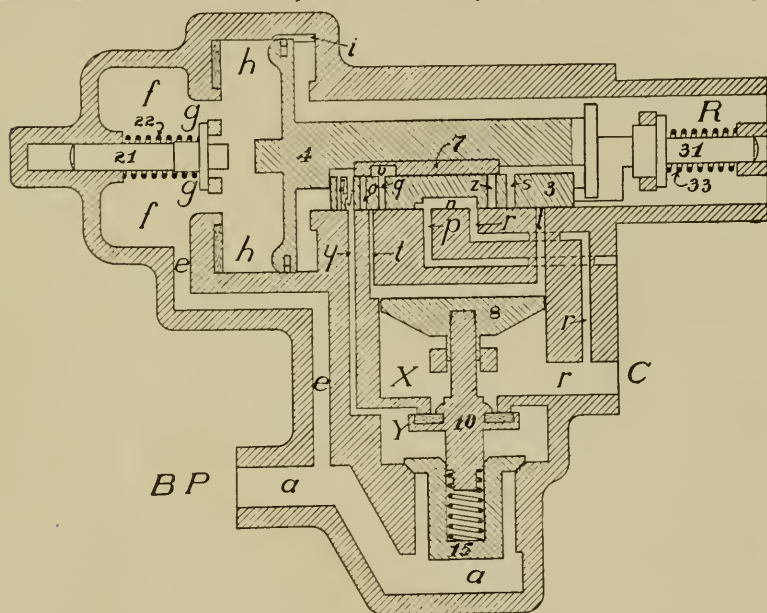


Fig. 1. Full-Release and Charging Position.

ing port area, through which the air can feed into the auxiliary reservoir, sufficiently to enable it to handle the greater volume of the auxiliary reservoir of a 10-inch brake cylinder. In order to do this, the small port *j* is added to the slide valve of the K-2 triple valve only; this port registers with port *y* in the slide-valve seat, when in the full release position. Air then passes from chamber Y, through ports *y* and *j* to chamber R, and the auxiliary reservoir. Brake-pipe air in *a*, raises check valve 15 and supplies chamber Y with air as fast as it is required. Port *j* is so proportioned that the rate of charging the auxiliary reservoir of a 10-inch brake cylinder is made practically the same

as that of the 8-inch, which in full release is fed through the feed groove *i* only. In the following description, the K-2 triple valve only is referred to; the operation of the K-1 is exactly the same except for the absence of port *j*.

Air flows from the brake pipe to the auxiliary reservoir until their pressures become equal, when the latter is then fully charged.

Quick-Service Position—To make a service application of the brakes, air pressure is gradually reduced in the brake pipe, and thereby in chamber *h*. As soon as the remaining pressure in the auxiliary reservoir and chamber *R* becomes enough greater than that in chamber *h*, to overcome the friction of the piston 4

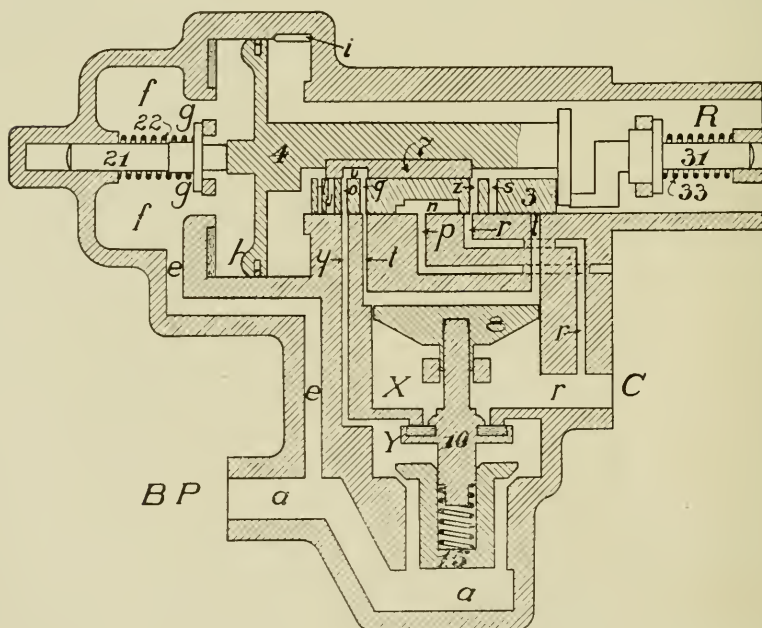


Fig. 2. Quick-Service Position.

and graduating valve 7, these two move to the left until the shoulder on the end of the piston stem strikes against the right-hand end of the slide valve, when it also is moved to the left until the piston strikes the graduating stem, 21, which is held in its place by the compression of the graduating spring, 22. The parts of the valve are then in the position shown in Fig. 2.

The first movement of the graduating valve closes the feed groove *i*, preventing air from feeding back into the brake pipe from the auxiliary reservoir, and also opens the upper end of port *z* in the slide valve, while the movement of the latter closes the connection between port *r* and the exhaust port *p*, and brings port *z* into partial registration with port *r*, in the slide valve seat. Auxiliary-reservoir pressure then flows through port *z* in the slide valve and port *r* in the seat to the brake cylinder.

At the same time, the first movement of the graduating valve connected the two ports *o* and *q* in the slide valve, by the cavity *v* in the graduating valve, and the movement of the slide valve brought port *o* to register with port *y* in the slide-valve seat, and port *q* with port *t*. Consequently, the air pressure in chamber Y flows through ports *y*, *o*, *v*, *q* and *t*, thence around the emergency piston 8, which fits loosely in its cylinder, to chamber X and the brake cylinder. When the pressure in chamber Y has reduced below the brake-pipe pressure remaining in *a*, the check valve raises and allows brake-pipe air to flow by the check valve and through the ports above mentioned to the brake cylinders. The size of these ports is so proportioned that the flow of air from the brake pipe to the top of emergency piston, 8, is not sufficient to force the latter downward and thus cause an emergency application, but at the same time takes considerable air from the brake pipe, thus increasing the rapidity with which the brake-pipe reduction travels through the train.

With the ordinary quick-action triple valve in a service application, all of the brake-pipe reduction has to be made at the brake valve, and the resulting drop in pressure passes back through the train at a rate depending on its length, size of brake pipe, number of bends and corners, etc., which cause friction and resistance; also a much heavier application of head than of rear brakes is caused at the beginning of the application, thereby running the slack in, which is liable at low speeds to be followed by the slack running out suddenly when the rear brakes do apply, causing loss of time and difficulty in making quick slow down and accurate stops, and, with very long trains, results in such serious losses through leakage grooves and feed grooves as to lose much braking power and even prevent some brakes from applying. With this new triple valve, only a small

part of the reduction is made at the brake valve to increase the reduction under each car, thereby rendering the resistance and friction in the brake pipe of much less effect, and hastening the application throughout the train. This is called the "Quick-Service" feature, and by means of it the rapidity of a full service application on a 50-car train is increased about fifty per cent. The rapid reduction of brake-pipe pressure moves the main piston 4 quickly to the service piston and cuts off any flow back from the auxiliary reservoir through the feed groove to the brake pipe; it rapidly drives the brake-cylinder piston beyond the leakage groove, and prevents loss of air through it; and yet permits applying with as moderate a brake force as desired. It also greatly reduces the brake-pipe reduction necessary at the brake valve for a certain brake-cylinder pressure, due to the fact, (1) that part of the reduction takes place at each triple valve, and (2) that the air taken from the brake pipe into the brake cylinder gives a little higher pressure than if the auxiliary-reservoir pressure alone were admitted, thus requiring a smaller brake-pipe reduction for the same cylinder pressure.

Full-Service Position—With short trains, the brake-pipe volume, being comparatively small, will reduce more rapidly for a certain reduction at the brake valve than with long trains. Under such circumstances the added reduction at each triple valve by the quick-service feature, might bring about so rapid a brake-pipe reduction as to cause quick action and an emergency application, when only a light application was intended. (The emergency application is explained later.) But this is automatically prevented by the triple valve itself. From Fig. 2 it will be noted that in the quick-service position, port *s* in the slide valve and port *r* in the seat do not fully register. Nevertheless, the opening is sufficient to allow the air to flow from the auxiliary reservoir to the brake-cylinder with sufficient rapidity to reduce the pressure in the auxiliary reservoir as fast as the pressure is reducing in the brake pipe, when the train is of considerable length. But if the brake-pipe reduction is more rapid than that of the auxiliary, the difference in pressures on the two sides of piston 4 soon becomes sufficient to slightly compress the graduating spring, and move the slide valve to the position shown in Fig. 3, called "*Full Service*." In this position, quick service port *y* is closed, so that no air flows from the brake pipe to the brake

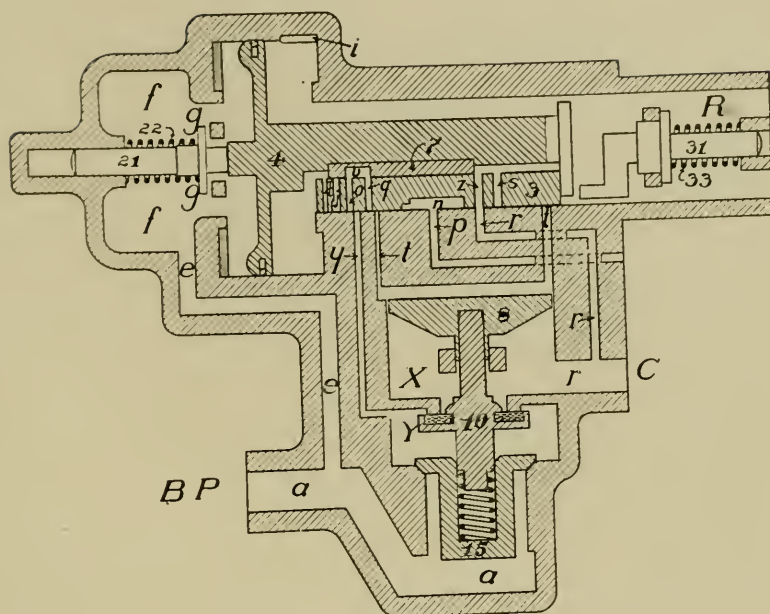


Fig. 3. Full-Service Position.

cylinder; the brake-pipe reduction being sufficiently rapid, there is no need of the additional quick-service reduction, so the triple valve cuts it out. Also, ports *z* and *r* are fully open, and allow the auxiliary-reservoir pressure to reduce more rapidly, so as to keep pace with the more rapid brake-pipe reduction.

Lap Position—When the brake-pipe reduction ceases, air continues to flow from the auxiliary reservoir through ports *z* and *r* to the brake cylinder, until the pressure in the chamber *R* becomes enough less than that of the brake pipe to cause piston 4 and graduating valve 7 to move to the right until the shoulder on the piston stem strikes the left-hand end of slide valve 3. As the friction of piston and graduating valve is much less than that of the slide valve, the difference in pressure which will move the piston and the graduating valve, will not be sufficient to move all three; consequently, the piston stops in the position shown in Fig. 4. This movement has caused the graduating valve to close port *z*, thus cutting off any further flow of air from the auxiliary reservoir to the brake cylinder. Consequently, no further change in air pressures can occur, and this

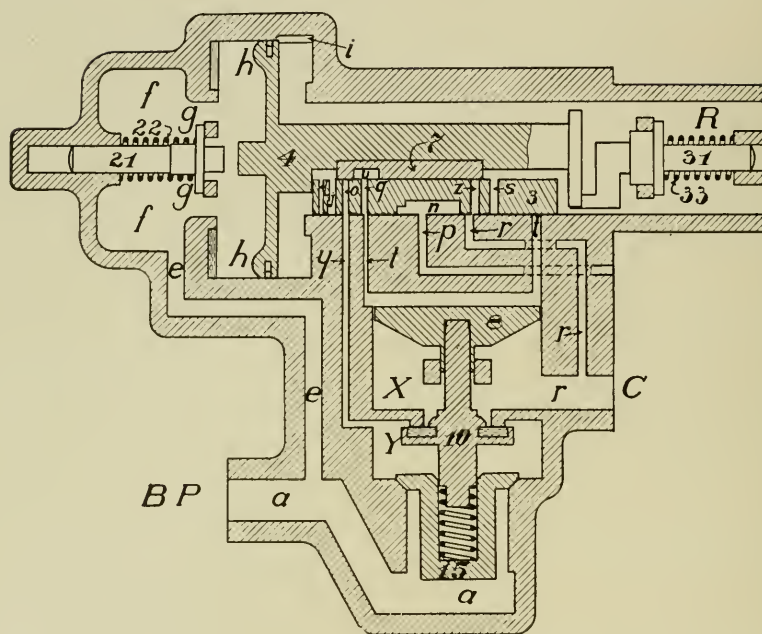


Fig. 4. Lap Position.

position is called "Lap," because all ports are *lapped*;—that is closed.

If it is desired to make a heavier application, a further reduction of the brake-pipe pressure is made, and the operation described above repeated, until the auxiliary reservoir and brake cylinder pressures become equal, after which any further brake-pipe reduction is only a waste of air. About twenty pounds brake-pipe reduction will give this equalization.

Retarded Release and Charging Position—The K triple valve has two release positions, full-release and retarded-release. Which one its parts will move to when the train brakes are released, depends upon how the brake-pipe pressure is increased; if slowly, it will be full release, and if quickly and considerably, it will be retarded-release. It is well known that in a freight train, when the engineer releases the brakes, that the rapidity with which the brake-pipe pressure increases on any car depends on the position of the car in the train. Those cars towards the front, receiving the air first will have their brake-pipe pressure

raised more rapidly than those in the rear. With the old standard apparatus, this is due to two things (1) the friction in the brake pipe; (2) the fact that the auxiliary reservoirs in the front at once begin to recharge, thus tending to reduce the pressure head by absorbing a quantity of air and holding back the flow from front to rear of the train. The retarded-release feature of this new triple valve overcomes the second point mentioned, taking advantage of the first while doing so. The friction of the brake pipe causes the pressure in chamber *h* to build up more rapidly on triple valves towards the front than those in the rear. As soon as its pressure is enough greater than the auxiliary-reservoir pressure, remaining in chamber *R* after the application above described, to overcome the friction of piston, graduating valve, and slide valve, all three are moved toward the right until the piston stem strikes the retarding-device stem, 31. The latter is held in position by the retarding-device spring, 33. If the rate of increase of the brake-pipe pressure is small, as, for example, when the car is near the rear of the train, the triple valve parts will remain in this position, as shown in Fig. 4, the brakes will release and the auxiliary reservoirs recharge as described under "*Full Release and Charging.*" If, however, the triple valve is near the head of the train, and the brake-pipe pressure builds up more rapidly than the auxiliary reservoir can recharge, the excessive pressure in chamber *h* will cause the piston to compress retarding-device spring, 33, and move the triple-valve parts to the position shown in Fig. 5.

Exhaust cavity *n* in the slide valve now connects port *r* leading to the brake cylinder, with port *p* to the atmosphere, and the brake will release; but as the small extension of exhaust cavity *n* is over port *p*, discharge of air from the brake cylinder to the atmosphere is quite slow. In this way, the brakes on the front end of the train require a longer time to release than those on the rear. This feature is called the "Retarded Release," and although the triple valves near the locomotive commence to release before those in the rear, as is the case with the H-triple valve, yet the exhaust of brake-cylinder pressure in retarded-release position is sufficiently slow to allow the rear brakes to release first. This permits of releasing the brakes on very long trains at low speeds without danger of a severe shock or break in two.

At the same time, the back of the piston is in contact with the end of the slide-valve bush and, as these two surfaces are ground to an accurate fit, their contact effectually cuts off communication between chambers *h* and *R* through feed groove *i*, preventing air from feeding through from the brake pipe to the auxiliary reservoir by this path. Also, port *l* in the slide valve registers with port *y* in the slide-valve seat, and pressure

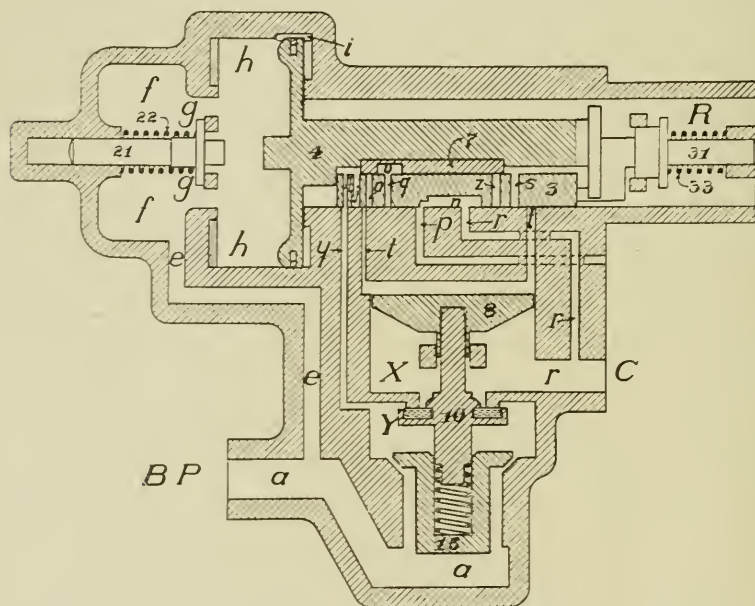


Fig. 5. Retarded-Release Position.

in chamber *Y* can flow through ports *y* and *l* to the chamber *R* and the auxiliary reservoir. Chamber *Y* is supplied with air under these circumstances by the check valve 15 raising and allowing brake-pipe air to flow past it. The area of port *l* is about half that of feed groove *i*, so that the rate that the auxiliary reservoir will recharge is much less than when the triple valve is in the full-release position.

As the auxiliary-reservoir pressure rises, and the pressures on the two sides of piston 4 become nearly equal, retarding-device spring, 31, forces the piston, slide valve, graduating valve, and retarding device stem back to the full release position shown in Fig. 1, when the remainder of the release and recharging

will take place as described above under "Full Release and Charging."

These features of the new valve are always available, even when mixed in trains with the old standard, the beneficial results being in proportion to the number of new valves present.

Emergency Position—Emergency Position is the same with the K triple valve as with the H type. Quick action is caused by a sudden and considerable reduction in brake-pipe pressure, no matter how caused. This fall in brake-pipe pressure causes the difference in pressures on the two sides of piston 4 to in-

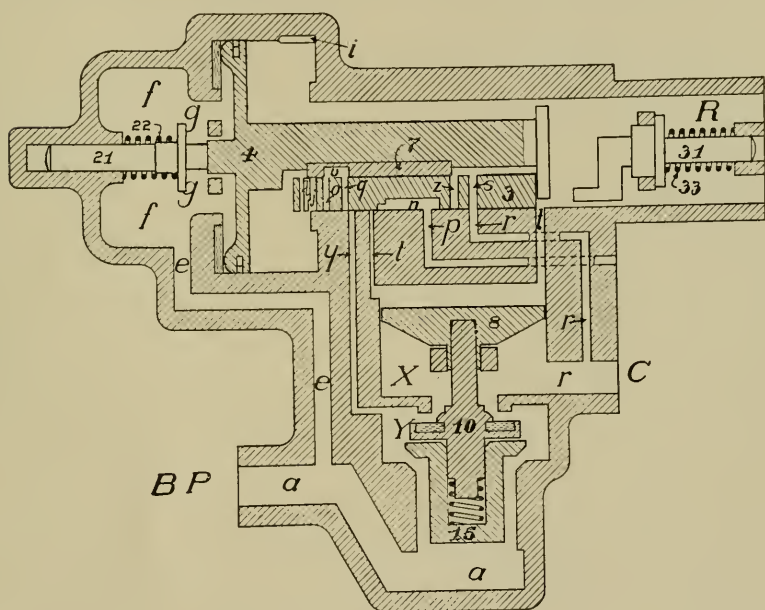


Fig. 6. Emergency Position.

crease very rapidly, so that the friction of the piston, slide valve and graduating valve is quickly and greatly overcome, and they move to the left with such force that when the piston strikes the graduating stem, it compresses graduating spring 22, forcing back the stem and spring, until the piston seats firmly against the gasket 23, as shown in Fig. 6. The movement of the slide valve opens port *t* in the slide-valve seat, and allows auxiliary reservoir pressure to flow to the top of emergency piston 8, forcing the latter downward and opening emergency valve 10.

The pressure in chamber Y, being instantly relieved, allows brake-pipe air to raise the check valve 15 and flow rapidly through chambers Y and X to the brake cylinder, until brake-cylinder and brake-pipe pressures equalize, when both check valve and emergency valve are forced to their seats by the spring in the former, preventing the pressure in the cylinders from escaping back into the brake pipe again. At the same time port *s* in the slide valve registers with port *r* in the slide-valve seat, and allows auxiliary-reservoir pressure to flow to the brake cylinder. But the size of ports *s* and *r* is such that very little air gets through them before the brake pipe has stopped venting into the brake cylinder. This sudden discharge of brake-pipe air into the brake cylinder has the same effect on the next triple valve as would be caused by a similar discharge of brake-pipe air to the atmosphere. In this way each triple valve applies the next, thus giving the quick and full application of all brakes, made heavier than full service application through the greater amount of brake-pipe air admitted to the brake cylinders. The rapidity with which the brakes apply throughout the train is so much increased that in a 50-car train it requires less than three seconds; the brake-cylinder pressure is also increased approximately twenty per cent.

The release after an emergency is effected in exactly the same manner as after a service application, but requires a longer time, owing to the higher brake-cylinder pressures and lower brake-pipe pressures.

The *Quick-Service Feature* makes it possible, in response to a service reduction, to start the application of the brakes on the end of a long train in half the time that is now required when cars are equipped with the old style of triple valve. This feature consists in venting brake pipe pressure through a small port from the brake pipe into the brake cylinder; this pressure acts to slightly augment the pressure resulting from that of the auxiliary reservoir flowing into the brake cylinder. As soon as the first triple assumes service position this reduction takes place, with the result that the secondary reduction aids the brake valve to hasten the reduction of brake pipe pressure being made with the brake valve. This local reduction results in a quick response from the triple valve on the following car,

this in turn on the succeeding one, and so on throughout the train, similar to the action, with which all are familiar, in the emergency application of the brake with the present quick-action triple. The result is that the effect of pipe friction is practically eliminated, while at the same time the quick-service triple valves, acting as so many brake valves, aid the brake valve in making any required reduction. It will thus be seen that pipe friction is reduced to a minimum, the cylinder pressure is increased for a given reduction, the action of the brakes throughout the train is positive in response to light or heavy reductions, and less time is required for a given amount of brake pipe reduction to be made, and a given cylinder pressure to be obtained.

The positive action referred to makes it possible to apply all brakes on an 80 and sometimes a 100-car train with a brake pipe reduction of 5 pounds, whereas, with the old triple, a positive and corresponding action of all brakes does not result with a 5-pound reduction on a train of but 50 cars. Not only can all brakes be applied with light reductions, but the braking power developed throughout the train is practically the same, in contradistinction to the results obtained with the old standard valve with which all of the brakes are not applied by a light brake pipe reduction and with which a greater braking power results on the cars at the front of the train.

The general understanding is that when using the old triple valve, these valves do not respond to a light reduction. This may be the case in some instances, but it is more likely that the valves move, but owing to the slowness of the reduction, the tendency is for air from the auxiliary reservoir to flow slowly into the brake cylinder and escape to the atmosphere through the leakage groove which is exposed until the piston has traveled a certain portion of its stroke.

Owing to the quicker and more positive action of the new valve, it is needless to state that the length of stop is materially lessened, as compared with what can be done by using the old standard valve. (See Fig. 7.) With the K valve a 5-pound reduction will bring a train to rest in a shorter distance than will any amount of service reduction when using the old valves. This being the case, it can readily be seen that the improved

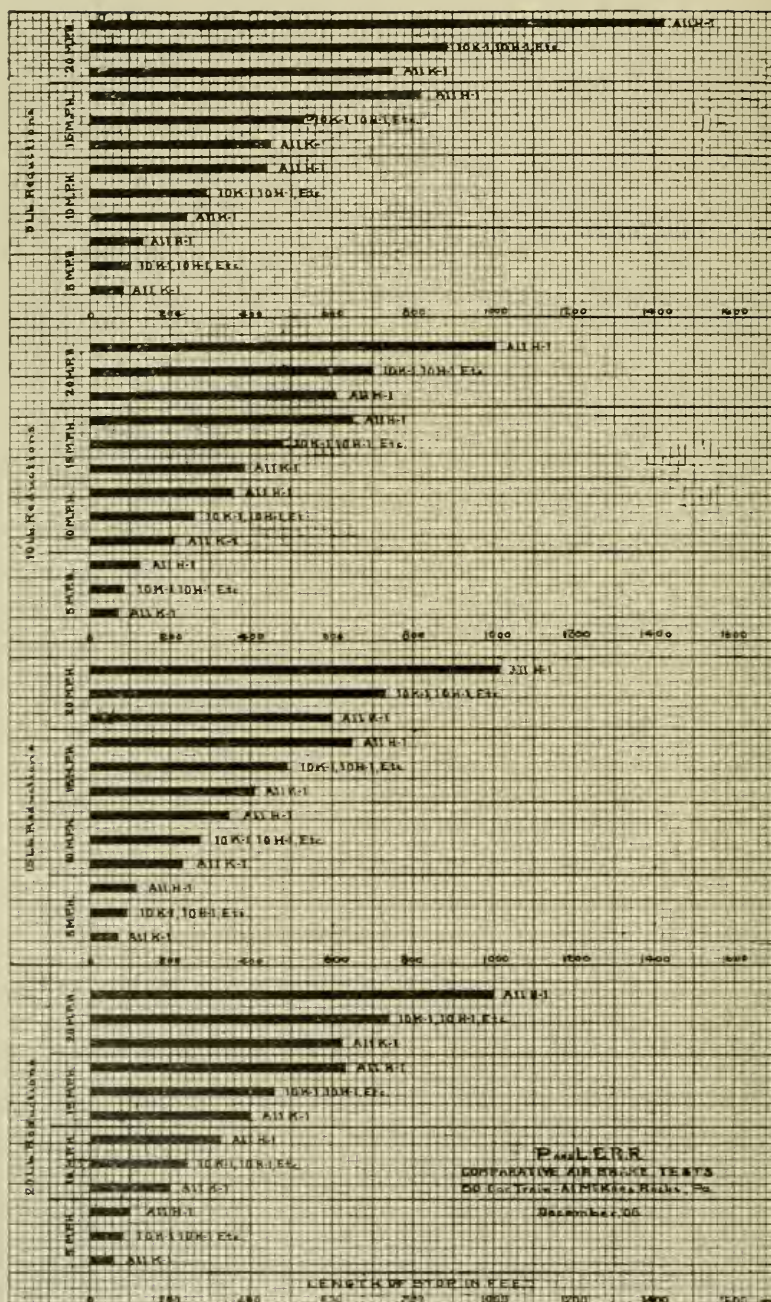


Fig. 7. Comparative lengths of stop of 50-car train from different speeds, with different brake-pipe reductions, when equipped with triple valves as follows: (1) all old type; (2) mixture of old and new types; and (3) all new type.

brake is not only much more efficient as to its stopping power, but there is an economy of air consumption and an increased factor of safety that is all important in considering the conditions which must be met in freight train handling.

Uniform Recharge: In grade service it is customary, in recharging, to permit the brake valve handle to remain in release position as long as possible to accomplish a recharge. The result is that the auxiliaries at the front of the train are somewhat overcharged. When the brake valve handle is returned to running position air cannot feed into the brake pipe until this pressure is below that for which the feed valve is adjusted to open. Due to the rear reservoirs not being charged with a pressure equal to those near the engine the former still continue to take air from the brake pipe, and the result is a reduction at the front of the train which causes a re-application of the brakes on cars where the reservoirs have become overcharged. The usual custom is to allow the brake valve handle to remain in running position a sufficient time to permit of the application referred to, at which time the brake valve handle is again placed in release position momentarily to release the brakes which have re-applied. The result is that more work is being done on the wheels of the cars at the front of the train, thus tending to overheat same, and the second release referred to results in a waste of air and more labor for the pump, while if the brake valve handle were not again placed in release position momentarily some or all of the brakes that reapplied would remain applied and the wheels on these cars would be endangered. If, instead of returning the brake valve handle to running position, as described, the valve handle were placed in service position and a light service reduction made, the brakes at the front of the train only would respond, with the result that these brakes would do considerably more than their portion of the work and the rear brakes would not apply until such time as another reduction was made sufficient to reduce the brake pipe pressure below that of the auxiliary reservoirs throughout the train.

With the new triple valve the action just described does not result, in the same length of time nor the same degree, owing to the Uniform-Recharge feature of the valve.

This feature consists in an arrangement of ports such that

the feed to the auxiliary reservoir is diminished whenever the pressure in the brake pipe exceeds that in the auxiliary reservoir an amount sufficient to compress the Retarded-Release spring, which spring it is possible to compress on approximately the first 30 cars of a long freight train. Owing to the practical elimination of this undesired overcharge at the head end of the train, the brakes do not re-apply at the front, as just described in connection with the old triple valves. The result is that the auxiliary reservoirs throughout the train are recharged to practically the same pressure, and all brakes respond to a light or heavy reduction, as the case may be, when the brake valve handle is placed in service position. The effect is that in grade work the heating of the wheels is necessarily uniform, and the element of danger from overheating wheels is greatly reduced when using the new valves as compared with the old. It is conceded that the use of an air brake results in a more uniform heating of the wheels than where a train is controlled by hand brakes; the improved valve is an added step in the direction of still further reducing the uneven heating.

It has been asked if the new valve will be much of an advantage after the brakes have been once applied and the retaining valve handle placed in the operative position. It certainly will be an advantage, for less brake pipe reduction is required; the Uniform-Recharge feature is most important under these conditions, and the Quick-Service not only gives a quicker serial response, causing all brakes that have leaked off to re-apply and to apply with greater power, but also gives a higher cylinder pressure on those that are still on at the time a reduction of brake pipe pressure is made. The Retarded-Release feature is especially important at this time if any retaining valves are inoperative, in which case the retarded release will cause a slow reduction of brake cylinder pressure.

Few realize the fact that it is a simple matter to find that 50 per cent of the retaining valves do not retain, and, in many cases, do not even retard the release. A great number of the defects which render the retaining valve inoperative can be detected without the necessity for a test; the condition of this valve otherwise, as well as that of the cylinder packing leather and their effect on the retaining feature of the retaining valve, can only be told by test. The worse such conditions are the

greater the necessity for the Quick-Service and Retarded-Release features in particular and the Uniform-Recharge feature in general.

The Retarded Release: This feature permits of the brakes being released at the rear of the train, if desired, before those at the front. This action causes the slack to bunch in from the rear instead of, as at present, running out from the head end with a strong tendency to produce jerks that often result in break-in-twos and probable damage and delay. The Retarded-Release is controlled by the spring already referred to, which

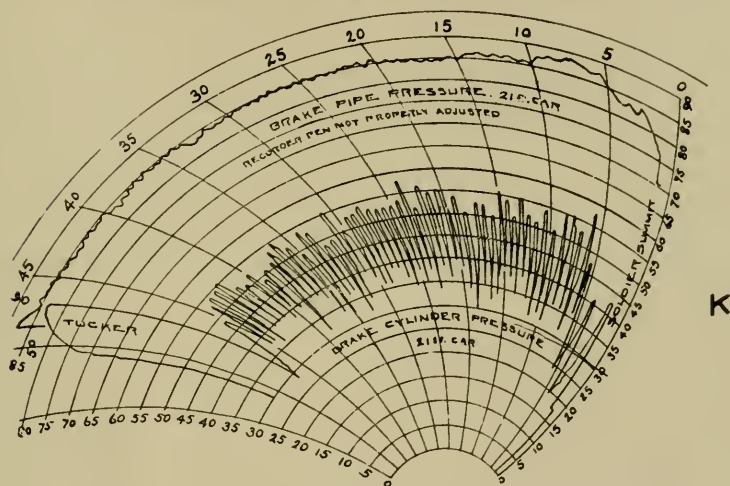


Fig. 8. Recorder chart showing brake cylinder pressure, 21st car, with K Triple Valve, D. & R. G. Test.

spring it is also necessary to compress to obtain the Uniform-Recharge. It will thus be seen that whenever the Retarded-Release occurs the Uniform-Recharge will be obtained as well. The retarded release will, as previously explained, result in the slack bunching rather than stretching out. The reservoirs at the front of the train will be recharged more slowly, and more air will be available with which to release and recharge those on the rear more quickly.

Engineers handling long freight trains in grade work make a reduction of brake pipe pressure, and it is often a number of seconds after the reduction has been made before the sensation is produced which tells them that the desired retarding

power of the brakes is manifesting itself. This interval of time is frequently such that a second reduction will be made so closely following the first that more power will finally be developed than is actually required. This will necessitate a premature release to prevent reducing the speed to an undesirable extent. This is much less likely to happen with the new triple, with which the response is obtained more quickly and with which we can expect to do much more accurate work and with less skill on the part of the operator.

The emergency feature of the valve is unchanged.

The most severe shocks which result from emergency applications are those obtained in trains of mixed empty and loaded cars or on long trains composed entirely of empty cars. With trains in which the cars are all loaded no trouble whatever is experienced. If a valve is furnished which stops the trains in comparatively short distances by the use of the service application of the brake it is hardly necessary to state that the occasion for using the emergency application, with the damage incident thereto, will be greatly reduced.

In designing the new valve, the importance of having no detail inserted which would prevent old valves being built over into the new type was fully appreciated and arranged for.

The Westinghouse Company is prepared to convert the old into the Quick-Service type of triple valve and is already doing this. A supply of the improved valves is kept in stock, so that they may be shipped at once upon receipt of the old ones without the necessity for holding the valves returned until repaired. This practice has been found to be a great convenience to the railroad companies.

Information is sometimes requested as to what effect in the way of buff and tension will be produced by the use of the new type of valve. This question is best answered by stating, that during the past four years, the valve was developed on a 50 and 65 car train composed of old wooden-sill box cars that had been in service ten and twelve years. The draft gear was of the single gear spring gear type and could not be said to be in more than fair condition, some of it being very poor. Tests were carried out in empty and mixed empty and loaded

car trains. These tests required some months and were not discontinued until the action was such as to be entirely satisfactory with this class of car. If the action is satisfactory with these old cars there is most certainly nothing to fear from the more modern equipment, practically none of which has anything with less capacity than a 40,000 lb. twin spring gear.

Tests have been made by several different railroads to ascertain what results could be obtained by the use of the Quick-Service triple valve, both when used alone, also in combination

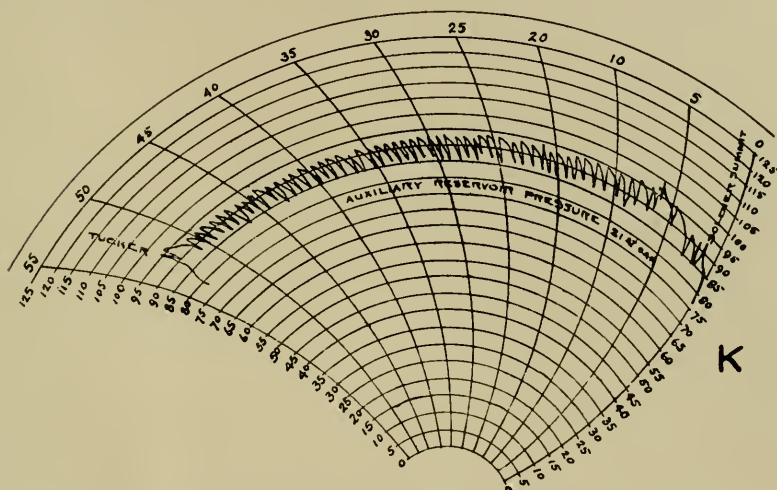


Fig. 9. Recorder chart showing auxiliary reservoir pressure, 21st car, with K Triple Valve, D. & R. G. Test.

with the triple valves at present in use. The tests referred to herein are those made by the P. & L. E., the Sante Fe, the D. & R. G. and the Philadelphia & Reading railroads. The former made tests upon a level track and were more along the line of comparing the relative stopping merits, while those of the two latter showed the comparative results that could be obtained in heavy grade service where the conditions were most severe. The trains on the D. & R. G. and the P. & R. were taken just as they came and were handled by F. W. Ainsworth, General Air Brake Inspector of the D. & R. G., and by one of the P. & R. engineers.

Following will be found conclusions drawn from both tests, these being based on the data obtained:

CONCLUSIONS DRAWN FROM RESULTS OBTAINED IN THE P. & L. E. TESTS.

DECEMBER, 1906.

It was clearly demonstrated that the introduction of the new valve greatly improved the action of the old one, and the benefits increased in proportion to the number of new valves in the train as shown in Fig. 7. The old and new types of valves operate in perfect harmony.

From the results obtained it will be seen that, owing to the shorter service stops accomplished by the use of the more prompt and positive acting K triple valve, there will be much less occasion for the use of the emergency application with its attendant objectionable results. A 5-pound reduction with the K valve, speed 20 m. p. h., stopped the train in 750', or 250' shorter distance than was accomplished when using a 20 lb. reduction and all old style valves. A 5-pound reduction with

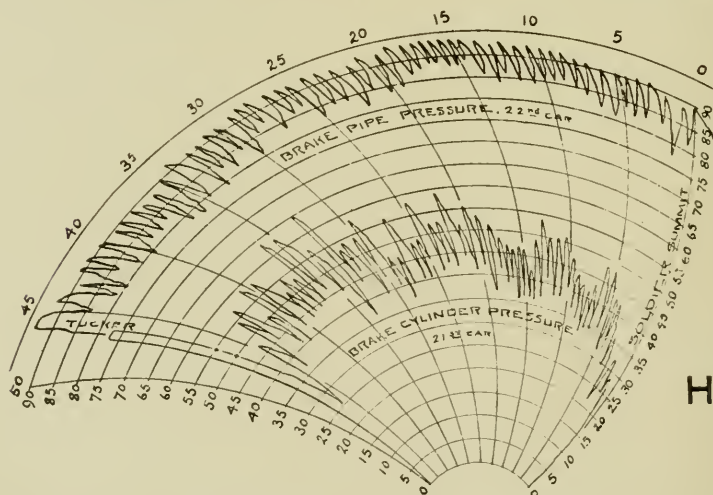


Fig. 10. Recorder chart showing brake cylinder and brake pipe pressure, 22nd car, with H Triple Valve, D. & R. G. Test.

the old valves required 1430' in which to bring the train to rest. The same reduction and speed when using 50 per cent of each valve brought the train to rest in 890'. The best stop made with any reduction when using the old valves was 990'.

The lighter service reductions with the new triple valve

must necessarily effect a considerable saving in steam economy as well as greatly reduce the wear and tear on the pump.

Owing to the lighter reductions necessary with the new valve it will take a correspondingly less time to accomplish a recharge. The factor of safety is increased proportionately.

Brakes will respond to light reductions on practically any length of train when using all K valves or 50 per cent of them. On very long trains all brakes cannot be applied with the old valve with a service application, regardless of the amount of reduction.

The more positive action of brakes operated by the improved triple valve will accomplish stops without the necessity of making reductions sufficient to fully equalize auxiliary and brake cylinder pressures. This being the case, the uneven release, due to uneven piston travel, will have much less occasion to manifest itself and the result will be materially lessened shocks in train caused by the unevenness of the release.

SANTE FE TESTS.
FORT MADISON, IOWA.
JUNE, 1906.

These tests covered the same ground as those made on the P. & L. E. The conclusion drawn from these tests were borne out in every respect by those on the P. & L. E.

CONCLUSIONS DRAWN FROM THE RESULTS
OF TESTS MADE ON THE D. & R. G. R. R.

FEBRUARY, 1907.

Fifteen hundred tons can be handled with K triples and 15-30-lb. retaining valves, on a 200-ft. grade practically straight, and with a greater factor of safety, than can 850 tons with F-36 triples and 15-pound retainers. There is no doubt but that the 11-inch pump, K triples and 15-30 retainers will handle, and with an ample margin of safety, 2000 tons, exclusive of the engine and tender, on this grade. Fifteen hundred tons was handled using 35 per cent of 15-pound retainers and all K triple valves with the exception of four old style.

It was demonstrated that the wheel heating was much more uniform on the trains handled with the K valve, the wheels

at the rear being practically the same temperature as those ahead. With this uniformity of heating there will be fewer cracked and broken wheels.

The air consumption was shown to be much less with the K valve.

It was demonstrated that the controlling power of the K valve was not less than 35% greater than with the old valve.

The available time for recharging, comparing the two best runs made with both valves, is 300% in favor of the K valve.

A much more uniform speed can be maintained with the K valve.

It was noticeable to a marked degree that the speed of the train was checked much more quickly with the K valve. The recharging feature of the K valve was entirely satisfactory to all present and was better and more uniform than with the old valve which had a much shorter time in which to accomplish a recharge.

The slack action was all that could be desired. This was tested out on two different runs; in the first the rear half of the train was equipped with the K valve and in the second the opposite arrangement was made.

- It was agreed by all that the retarded release feature reduced the strain on the draft gear following a release. This will reduce the number of break-in-twos.

The average reduction on the different runs with the K valve was 4.8 lbs., with the H 7.5 lbs. The average of the maximum reductions on the different runs was 7.6 lbs with the K and 13.3 lbs. with the H valve, and it must be borne in mind that the tonnage handled with the K's was nearly twice that handled with the H valves. This shows clearly the saving of air by use of the new valve. In grade service this is especially important.

A higher average speed was maintained and the tons per good brake averaged about three tons greater with the new valve, and there was a large reserve braking force available with which to stop at all times.

With the H valve the time that the brakes were on compared with the time they were off was as 1 to $1\frac{1}{3}$. With the K valve it was as 1 to $3\frac{1}{2}$. This shows how much more time

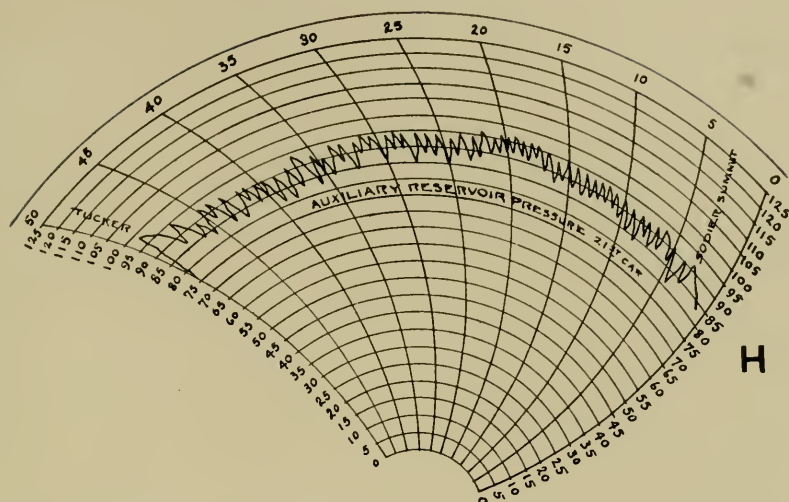


Fig. 11. Recorder chart showing auxiliary reservoir pressure, 21st car, With H Triple Valve, D. & R. G. Test.

was available in which to accomplish a recharge with the new valve.

With the K valve, no matter how light the reduction, there was not a case where the recorder chart did not show a response of the brake on the last car. Figs. 8 and 9, as compared with Figs. 9 and 10, illustrate the much finer and more uniform work that is made possible by the use of the K as compared with the H type of valve. The results traced on the chart show this conclusively.

The following are the conditions under which these tests were made: One 11" pump; main reservoir capacity 60,000 cubic inches; capacity of cars, 60, 80 and 100,000 lbs.; braking power, 70, 80 and 90%; there are very few of the latter and the others are about equally divided between 70 and 80%; triple valves—trains of H and K valves, and with these mixed; maximum number of tons handled with K valves and 65% 15-30, 35% of 15 lb. retainers, 1505 tons; with H valves and 100% 15-30 retainers, 1146 tons; grade, 200 feet and practically straight; speed, 9 to 10 m. p. h.

Since the completion of the D. & R. G. tests the K valve and 15-30 retaining valve have been made standard for all new

equipment: 15-30 retaining valves will be applied at once to all equipment now in service and the old will be changed into the new style triple valve as fast as the old valves come in for repairs.

Owing to the uncertainty of the response of H triple valves at the rear of the train it is not advisable to handle over 25 cars on this grade unless the K valve is used.

PHILADELPHIA & READING TESTS.

In these tests the same desirable and important features were brought out as in the D. & R. G. tests.

The following will give a general idea of the conditions under which the train was handled:

Two 9½" pumps; main reservoir capacity, 73,000 cu. in.; capacity of cars, 100,000 lbs.; light weight, 41,500 lbs.; per cent of braking power to light weight, 85; K-2 triple valve and 15-30 retaining valve; average total weight of car and contents, 71.5 tons; number of cars, 20; 100,000 capacity; maximum grade, 190 feet; minimum, 173 feet; average, 175 feet; speed with air-brake trains using K triple valve, 13.2; hand brakes, 8.25 m. p. h.; a gain of 61% in time in favor of the K valve.

The usual tonnage in trains controlled by hand brakes is 1120, running time 40 minutes; the tonnage in the air-brake tests was 1429 tons (27.6% more than the hand-braked trains) and the running time was 25 minutes or 15 minutes less than with the hand-braked train; 8.25 m. p. h. with hand and 13.2 m. p. h. with air brakes. The maximum reduction made at any time was 5 lbs.

The results obtained were most gratifying. During the last test several of the officials of the Philadelphia & Reading were present, including Mr. Taylor, S. M. P., who has been very much interested in what the K valve would accomplish owing to the trouble they have experienced in various ways while controlling train by hand on the grade in question. The success of the run, as compared with what could be accomplished by the use of hand brakes or the old style triple was such as to lead them to, at the completion of the run, immediately change an order for 5000 brakes to specify K valves and 15-30 re-

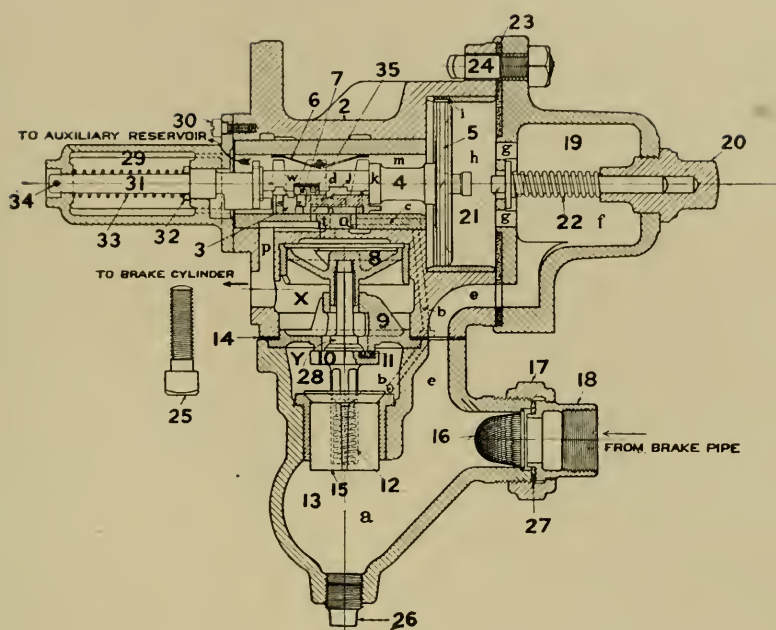


Fig. 12. Section of Type "K-1" Freight Triple Valve.

taining valves; since then an order for 900 sets of brakes already received was changed to include K valves and 15-30 retainers and we have orders to build all old into new style triple valves as the old type is sent in for repairs. A large number of triples on their large capacity cars will be changed to the K type at once.

As a result of the various practical tests that have been conducted on different railroads, 96,000 sets of K triple valves (exclusive of old type of valves converted into the K type) have been ordered by railway companies to June 1st, 1907. A list of the roads ordering this device is given below; those being marked with an asterisk having adopted it as standard:

Atlantic Coast Line.

*Atchison, Topeka & Santa Fe.

Boston & Maine.

*Buffalo, Rochester & Pittsburgh.

Butte, Anaconda & Pacific.

*Central Railroad of New Jersey.

Chicago, Burlington & Quincy.

- Chicago, Joliet & Eastern Railway Co.
- Chicago & Northwestern.
- Canadian Northern.
- Canadian Pacific.
- Chicago, L. S. & E.
- California Northwestern.
- Charlestown & Western Carolina Ry. Co.
- Chesapeake & Ohio.
- *Colorado Midland.
- Copper Range.
- *Denver & Rio Grande.
- Diamond & Caldor.
- *Duluth & Iron Range R. R. Co.
- *Duluth, Missabe & Northern Railway Co.
- Duluth, South Shore & Atlantic R. R. Co.
- Elgin, Joliet & Eastern.
- El Dorado Lumber Co.
- *Gulf & Ship Island.
- Hanna, M. A. & Co.
- *Idaho & Washington Northern.
- Lake Superior & Ishpeming Railway Co.
- *Lehigh Valley.
- *Missouri Pacific.
- Marquette & S. E.
- *New York P. & Norfolk.
- New Jersey Zinc Co.
- Northern Pacific.
- P. & L. E.
- *P. R. R.
- *Pennsylvania Company.
- Pgh. E. Coal Co.
- *Philadelphia & Reading.
- *Pacific, Portland Cement Co.
- Quincy Mining Co.
- *San F., Oak & San Jose.
- *St. Louis Southwestern.
- Standard Steel Car Co.
- South & Western.
- Scott Co.
- *Tonopah & Goldfield.

*Vandalia Railroad.

Wash. Coal Co.

*Wabash Railroad.

Westmoreland Coal Company.

VICE-PRESIDENT: Gentlemen, it has been our pleasure to listen to a very interesting paper. Our custom has been to adjourn for luncheon at ten o'clock, but with the interesting material Mr. Turner has given us it would hardly be fair to him to omit the discussion, and I think therefore that we will have a brief discussion, say of fifteen minutes. Any questions you may desire to ask Mr. Turner he will be very glad to answer. He is here with abundant information.

MR. A. STUCKI: I would be glad to see this cut on the last page in its entirety. Those ports and valve bushings are really not printed. I take it for granted this was so as not to go over the margin of the page. That is the emergency valve and there may be some objections to printing that; but if there are no specific objections I would make a suggestion that that card be made of a larger size to show the valve portion. That is the interesting thing in it, and I understand, is what you want.

MR. W. V. TURNER: I agree with you in respect to that and, of course, as far as we are concerned, we are willing to do anything that the Railway Club desires. I may say that we have cuts of this valve in all of its positions, made diagrammatically, which show, no matter what the operation may be that is taking place, just the register of the ports. If the Club at all desires it we will be perfectly willing to furnish diagrammatic views. We already have the cuts and everything, so that the expense would be light.

VICE-PRESIDENT: If there is no further discussion I will announce to the Club the members of the Committee to take up the matter of inducing the Master Car Builders and Master Mechanics Associations to select Pittsburgh as the place for the next annual convention. I think the time is ripe for these conventions to be held in Pittsburgh, and I hope every member of the Club will lend a hand. When the motion was passed I received an impression that the committee should not be large. But the more I have thought over it the more I re-

alize that there should be several members appointed on a committee of this kind. I have made the number eleven, the gentlemen being close around the center of Pittsburgh, because they must get together frequently and act rapidly. At the same time I hope all the members of the Club will assist them and do everything in their power to bring about the result desired. It will take a good deal of missionary work. The Committee is as follows:

D. M. Howe, Chairman; Edward Kerr, G. P. Sweeley, L. H. Turner, E. M. Herr, M. A. Malloy, F. M. McNulty, J. F. Prendergast, G. N. Riley, F. H. Stark, J. D. Conway.

I will ask Mr. Conway to notify these gentlemen as soon as possible. All the better if he can get it done tomorrow. It will require early action, as there is a great deal to be done to get the convention here.

I have been reminded during the evening that this is the last meeting before the so-called summer recess, when all the truthful people will go fishing and to other places. So, of course, when our next meeting rolls around and we meet about the lunch table and hear the stories we will have some very interesting ones to listen to.

MR. GEORGE E. GIES: I move that a vote of thanks be extended to Mr. Turner in appreciation of his very able paper and his kindness in presenting the subject in such a concise manner.

The motion, being duly seconded, was put to a vote and carried.

VICE-PRESIDENT: On behalf of the Club I take pleasure in extending to you the thanks of the organization.

ON MOTION, Adjourned.

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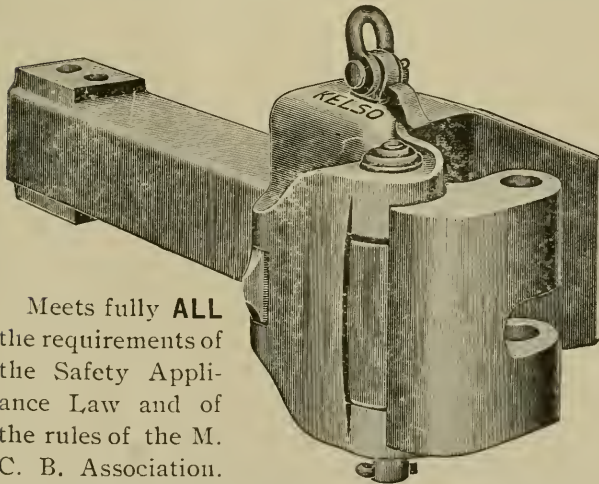
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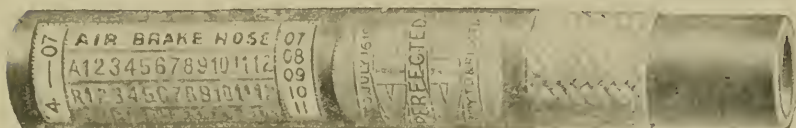
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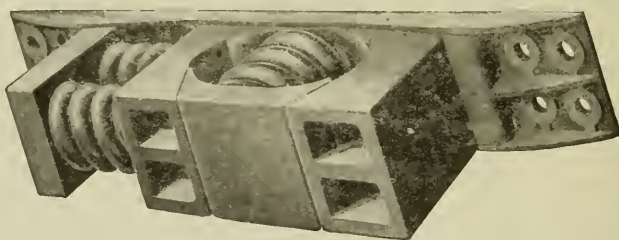
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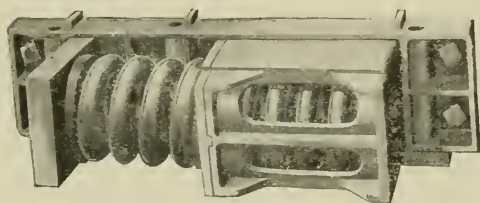
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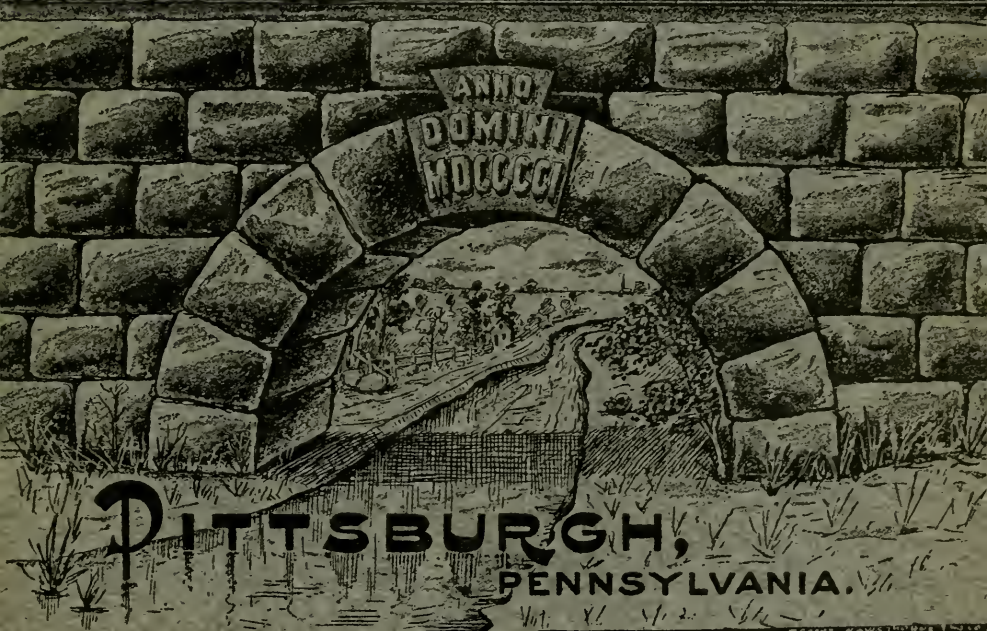
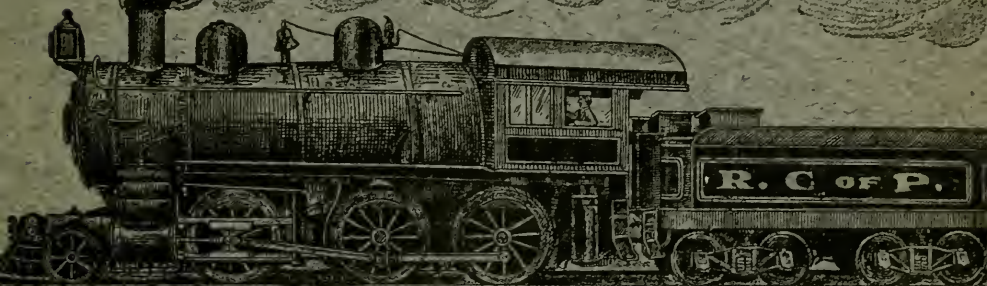
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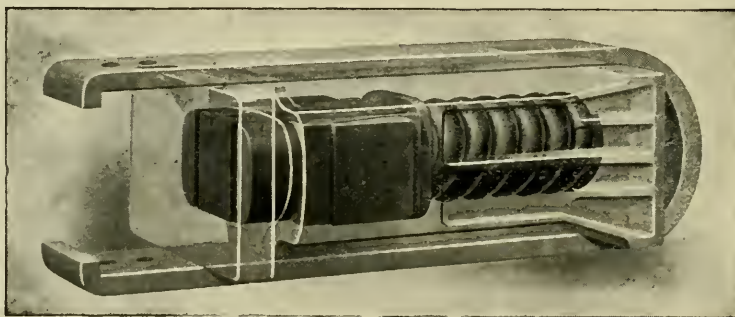
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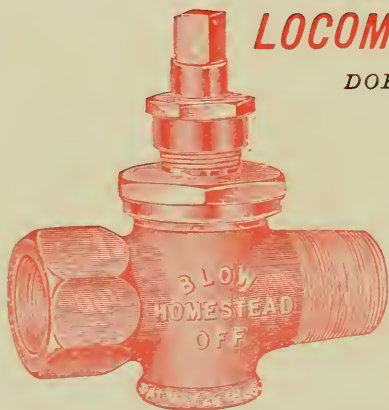
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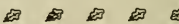
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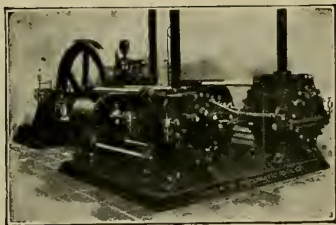
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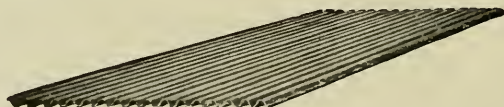
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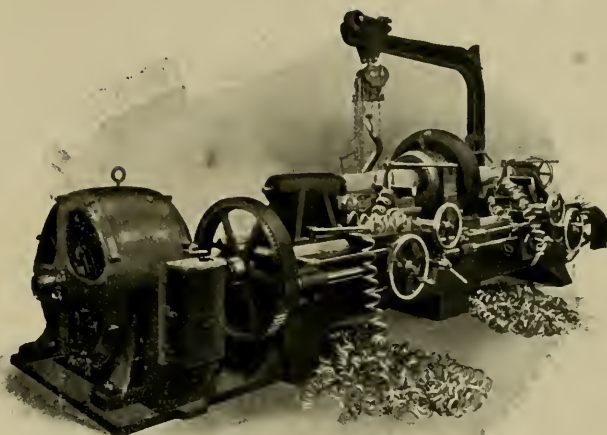
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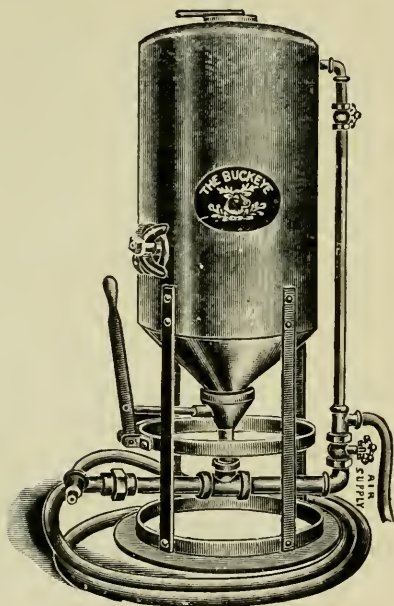


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Pittsburgh, Pa., Sept. 27, 1907.

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J. D. Conway, Secretary, General Offices P. & L. E. R. R., Pittsburgh, Pa.

Meetings held fourth Friday each month, except June, July and August.

**PROCEEDINGS OF MEETING,
SEPTEMBER 27th, 1907.**

The meeting was called to order at the Monongahela House, Pittsburgh, Pa., at 8:00 o'clock, P. M., with President F. H. Stark in the chair.

The following gentlemen registered:

MEMBERS.

Ault, C. B.	Knight, E. A.
Baker, Jonathan H.	Lace, Thos. C.
Barnsley, Geo. T.	Lanning, J. F.
Bihler, L. C.	Lobez, P. L.
Brown, Raymond B.	Logan, Henry M.
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Cox, P. L.	McIlwain, J. D.
Cunningham, W. F.	McNulty, F. M.
Donovan, H. A.	Nagle, W. E.
Dunlevy, J. H.	Nessle, J. B.
Elder, Thos. W., Jr.	Nickerson, S. N.
Everest, W. B.	Noble, D. C.
Fischer, Charles L.	Oliver, W. H.
Frank, Laurence W.	Partington, James.
Fuller, S. R., Jr.	Pearce, Robert M.
Gale, C. H.,	Peach, W. M.
Gano, J. H.	Porter, H. V.
George, Miles E.	Postlethwaite, C. E.
Grove, E. M.	Randall, E. J.
Gulick, H.	Redding, D. J.
Gurry, Geo.	Reeve, F. J.
Hackenburg, J. H.	Rhodes, Geo. P.
Haynes, J. E.	Riley, Geo. N.
Hench, N. M.	Riley, J. W.
Hetherington, S. C.	Sanville, W. F.
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Hyndman, F. T.	Shaler, Fred J.
Illingworth, T. W.	Shannon, Chas.
Jefferson, E. Z.	Suckfield, G. A.
Johnston, W. C.	Smith, D. W.
Kerr, Edward.	Stark, F. H.

Stewart, W. W.
 Stucki, A.
 Swann, J. B.
 Swartz, H. E.
 Sweeley, G. P.
 Taylor, H. G.
 Terry, W. A.

Townsend, T. E.
 Trinler, Chas. M.
 Warne, J. C.
 Weigel, F. S.
 Wells, D. L.
 Yohe, J. K.
 Zelch, John.

VISITORS.

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 Bowman, L. H.
 Bowes, Geo. W.
 Burgess, Geo. L.
 Canty, P. M.
 Casselberry, Harry.
 Collin, John E.
 Curran, Thos. F. V.
 Dean, H. J.
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 Harris, R. R.
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 Jefferson, H. F.
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 Landgraf, F. K.
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 Lowry, R. N.

Mensch, E. M.
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 Walters, Harry E.
 Weston, B. F.
 Wiles, G. R.
 Zelch, J. L., Jr.

The minutes of the last meeting being in the hands of the printer, the reading of them was dispensed with.

The Secretary read the following proposals for membership:
 Alleman, C. W., Clerk M. P. Dept., P. & L. E. R. R., Pittsburgh, Pa.

Baird, F. C., G. F. A., B. & L. E. R. R. Co., Frick Building, Pittsburgh, Pa.

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Burry, V. J., Draftsman, M. P. D., P. & L. E. R. R., Pittsburgh, Pa.

Caldwell, J. L., Asst. R. F. of E., P. & L. E. R. R., 406 Grove St., McKees Rocks, Pa.

Cole, Jewett, Inspector, P. R. R. Co., Room 207, Union Station, Pittsburgh, Pa.

Collin, J. E., Auditor, Western All'y. R. R. Co., Diamond Bank Bldg., Pittsburgh, Pa.

Donahey, I. W., Paymaster, Union R. R. Co., Port Perry, Pa.

Godley, R. H., Engine House Foreman, Penna. Co., No. 30 Parson St., Ashtabula, Ohio.

Graham, H. E., G. F. A., Pressed Steel Car Co., Pittsburgh, Pa.

Halliwell, C. J., Ass't. M. M., P. R. R. Co., Pittsburgh, Pa.

Heintz, A., Heintz Vapor Steam Heat, West. Air Brake Co., Wilmerding, Pa.

Keyser, R. H., Cashier, B. & L. E. R. R., Carnegie Bldg., Pittsburgh, Pa.

Lent, John F., Shippers' Traf. Mgr., 1110 Park Bldg., Pittsburgh, Pa.

Lorgabaugh, John R., Pur. Dep't., Carnegie Steel Co., Pittsburgh, Pa.

Mawhinney, M. S., care Frick Coke Co., Pittsburgh, Pa.

Miller, John F., Clerk, A. & S. R. R., Glenn Willard, Allegheny County, Pa.

Morrison, Douglas P., Elec. Engr., P. & L. E. R. R., Gen'l. Office, Pittsburgh, Pa.

Muhlfeld, J. E., G. S. M. P., B. & O. R. R., Baltimore, Md.

McKee, Frank W., Chief Electrician, Jones & Laughlin, Aliquippa Works, Woodlawn, Pa.

McKee, Ira E., Clerk, Union R. R. Co., Port Perry, Pa.

Norton, D. S., Inspector, M. P. Dep't., P. R. R. Co., Pittsburgh, Pa.

Oneal, J. E., Trav. Insp'r., Union R. R. Co., 428 Seddon Ave., Braddock, Pa.

Park, H. B., care Union Electric Co., Pittsburgh, Pa.

Parnell, J. W., Agent, Penna. R. R., Courtney, Pa.

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- Porter, M. R., Sales Manager, Pgh. Gage & Supply Co., 6317 Marchand St., Pittsburgh, Pa.
- Rebhum, C. F., Timekeeper, Union R. R., Bessemer, Pa.
- Richardson, E. F., Gen'l. A. B. L. B. & L. E. R. R., Greenville, Pa.
- Rinehart, H. W., Inspector, M. P. Dep't., P. R. R. Co., 28th St., Pittsburgh, Pa.
- Williams, W. J., Clerk, Penna. R. R., 211 Neshannock Ave., New Castle, Pa.

SECRETARY: These names have not as yet been approved by the Executive Committee.

PRESIDENT: These names will be referred to the Executive Committee, and upon approval the gentlemen will become members of the Club.

At the last meeting of the Club announcement was made of the death of a member. Mr. W. J. Martin, chief clerk to the Superintendent of Motive Power of the Pittsburgh, Shawmut & Northern Railroad Company. I wish to appoint as the committee to draft suitable memorial resolutions Messrs. George P. Brown, A. D. Chittenden and F. J. Reeve.

SECRETARY: Under the head of new business, I presume it would be in order to nominate officers for the ensuing year.

PRESIDENT: The following gentlemen were appointed a Committee on Nominations, Messrs. D. M. Howe, L. H. Turner and L. C. Bihler.

The Committee, through their Chairman, presented the names of the following gentlemen as nominees for the several offices to be filled for the year 1907-1908:

President,	{	H. W. WATTS.
First Vice President,	{	D. J. REDDING. W. J. BUCHANAN.
Second Vice President,	{	F. R. McFEATHERS. A. G. MITCHELL.
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Finance Committee,	{	D. C. NOBLE. H. V. PORTER. S. C. MASON. CHAS. LINDSTROM. T. F. KIRK.
Membership Committee,	{	D. M. HOWE. A. M. SCHOYER. J. B. SWANN. E. W. SUMMERS. A. STUCKI. G. P. SWEeley. F. M. McNULTY. M. A. MALLOY.
Secretary,	{	JOHN D. CONWAY. F. J. REEVE.
Treasurer,	{	J. D. McILWAIN.

UPON MOTION, the report of the Committee was accepted and the nominations closed.

MR. C. E. POSTLETHWAITE: Mr. President and Gentlemen—It seems to me that in view of the delightful afternoon most of us have had, it is in order to offer a vote of thanks to the Carnegie Steel Company and the National Tube Works, and

to the individual members of the Committee, not only for the pleasant entertainment, but for the opportunity of visiting the works at McKeesport and Bessemer.

To my mind it was especially considerate and thoughtful to include the ladies, giving them, as it did, an opportunity to see in a most favorable light the foundation of practically all of our work.

It is no easy matter to handle as large a crowd as we had to-day, and I congratulate Mr. Yohe and Mr. Terry on the train arrangements, and Mr. Townsend and Mr. Bihler on the nice way in which the crowd was handled through their respective plants. The invitation appealed to me when it first came, and I am heartily glad I went. I, therefore, move that a vote of thanks be extended, as stated.

The motion being duly seconded, was carried by a unanimous rising vote.

PRESIDENT: Gentlemen, we have now come to the discussion of the paper of the evening, and it gives me great pleasure indeed to introduce Mr. J. Kent Smith, who will present to you a paper upon the subject of Vanadium Steel.

VANADIUM STEEL

BY MR. J. KENT SMITH, CHIEF METALURGIST OF THE
AMERICAN VANADIUM COMPANY, PITTSBURGH.

When some years ago the statement was recorded that the addition of Vanadium to steel strengthened the latter, the asseveration did not appeal much to practical man for many reasons, two of the principal of which were: First, that Vanadium was looked upon as an exceedingly rare metal which was quite inaccessible for use in industrial operations, and, Secondly, that the extraordinary properties which Vanadium conferred on steel in addition to strengthening it were not even hinted at; in fact, it is only in very recent times that the chief benefit conferred upon steel by the correct addition of Vanadium has been recognized at all, that is, that of endowing it with extreme vitality, or phenomenally high resistance to the fatigue produced by re-

peated stresses and strains which in the end cause its fracture, although they may singly be below the elastic limit of the metal. Even now this fact has not received the full amount of recognition which it deserves.

Recent discoveries have caused Vanadium to pass entirely from the domain of the rare metals to the position of a metal which is readily obtainable in any quantities and at a price which, considering the small proportion necessary to be used, does not put any obstacle in the way of its employment in steels of even a moderately high grade, while the benefits accruing from its use, as I hope to show you, more than justify any increased cost attending its employment.

An immense deposit of Vanadium ore, of a grade which was never hitherto suspected to exist, or even to be capable of existence, has been developed, and is now being worked, by a company in this city. This company has erected a factory for the reduction, in large quantities, of this ore to the metallic state, and thus there is no practical limit to the amount of metal in its properly alloyed form which is now obtainable by the steel manufacturer.

Vanadium is commonly alluded to as a rare metal, but this denomination is correct in a limited sense only. Scientifically the description is entirely inaccurate, as Vanadium is one of the most widely distributed of the elements known to us; but in its general forms of distribution it occurs only in such minute quantities as to render any idea of its commercial extraction from such sources utterly impracticable. It is, however, exceedingly rare to find concentrated sources of Vanadium in any quantity, so rare, in fact, that the deposit previously spoken of may be reckoned as unique.

Vanadium is a silvery white, readily oxidized metal of a very high fusing point. Its alloy with iron, however, in the proportion of approximately two parts of iron to one of Vanadium possesses a melting point much below that of steel, and it is in this form that the metal is marketed for the use of the steel manufacturer. No difficulties in its employment are found, provided that reasonable precautions are taken in its addition, such precautions being fully deduced from, and explainable by, a portion of the subject matter of my remarks tonight.

It will be necessary in the first place for me to allude briefly and generally to the micro-structure of the ordinary engineering steels, or such steels as those which are known to metallurgists as "sub-saturated." Carbon is a necessary constituent of all steels, but this carbon is not held in mere solution in the steel nor is it disseminated in the steel in an elementary condition. The ground work of the steel may be said to consist of a carbonless iron of a greater or less degree of purity, and the properties of different forms of this carbonless iron, and their structure both from an intercrystalline and intracrystalline point of view, must first be considered both chemically and physically. Such carbonless iron is known generically as Ferrite. In the steel the carbon itself is combined chemically with another proportion of iron forming the chemical compound carbide of iron, a molecule of which contains three atoms of iron and one atom of carbon. This chemical compound alloys itself with more carbonless iron, each molecule taking to itself twenty-one more atoms of iron to form the eutectoid known as Pearlite. The particles of this pearlite alloy are distributed in pieces of greater or less size through the main ground work of ferrite, their size, distribution, etc., varying according to the last heat put upon the steel under "work," the rate of cooling, and so forth. From the foregoing it will be seen that, having careful reference to atomic weights, etc., a steel containing .89% of carbon would completely consist of pearlite, there being no excess of carbonless iron; such a steel would be called "saturated." If the carbon percentage exceeds this amount there would be an excessive quantity of carbide of iron over that required to form pearlite, and this would be called "supersaturated." But only the sub-saturated steel interest us to-night from an engineering point of view.

With these crude remarks, which I trust will be taken in a general sense only, some of the attributes conferred on steel by Vanadium may now be stated with some degree of clearness.

It has already been said that Vanadium is a readily oxidizable element. Amongst the metals it stands very high on the list with regard to its avidity for oxygen; so great is this avidity that under suitable temperature conditions it will decompose the oxides of iron and manganese. It is within the province of

the steel-maker to insure the practical absence of these oxides by normal means, but the addition of Vanadium insures the complete elimination of the last traces, thereby ridding steel of one of its most dangerous poisons. As their removal is effected by conversion into a light and readily fusible oxide of Vanadium which immediately passes into the slag, no danger of the "dryness" attending the use of some deoxidizing agents is encountered.

But even more important in the properties of Vanadium as a cleanser is the fact that it also eliminates combined nitrogen in the form of a stable nitride; this fact is readily seen both as a result of careful chemical investigation and of *macroscopic* examination. It will not be necessary, in view of the numerous contributions which have been published from time to time by many observers, for me to enlarge upon the deadly effects of nitrogen chemically contained in steel.

Passing from the benefits derived from the cleansing action of Vanadium (which work be it noted is accomplished at the expense of the ultimate Vanadium content of the steel) there are many other points to be observed. The solid solution of Vanadium in ferrite causes this ferrite to become much tougher from an intracrystalline point of view, and furthermore promotes the close interlocking of these crystals (as shown on the screen). Incidentally the ferrite crystals in themselves become somewhat stronger from a purely tensile point of view.

The main practical application of this fact lies in the employment of Vanadium in steel castings. It will, I think, be generally admitted that the great majority of castings fail in service through their inability to withstand the disintegrating effect of repeated stresses rather than to any original want of static strength and ductility. This lack of endurance cannot possibly be gauged by any static test.

The following table will fully illustrate the effect of Vanadium in increasing resistance to the development of "vibratory brittleness," and affords practical proof of the theoretical facts deduced from the remarks on the constitution of Vanadium ferrite, and its micro-structure.

Further, Vanadium ferrite offers greater resistance to the

Table No. 1.

VANADIUM STEEL CASTINGS

for LOCOMOTIVE PARTS

FERRO-VANADIUM, AS AN ALLOY, WHEN ADDED TO STEEL IN THE PROCESS OF CASTING, HAS A MARKED INFLUENCE ON THE GENERAL QUALITY THROUGHOUT, CLEANSING, AND BINDING TOGETHER THE MOLECULAR STRUCTURE, IMPARTING TO THE FINISHED PRODUCT VITALITY WHICH OTHERWISE WOULD BE LACKING, RENDERING RESULTS MORE EFFICIENT IN SERVICE WHERE SHOCK, STRAIN AND VIBRATION ARE CONSTANT, YIELDING PROPORTIONATELY A HIGHER ELASTIC STRENGTH, AND AFFORDING A MARGIN OF SAFETY ABOVE THE ORDINARY STEEL CASTING.

COMPARATIVE AVERAGE TENSILE & VIBRATION TEST. ORDINARY & VANADIUM STEEL CASTINGS. TEST PIECES TAKEN FROM CAST STEEL LOCOMOTIVE FRAMES.

STEEL -	ELASTIC LIMIT.	ULT. TEN. STRENGTH	RATIO -	ELONGATION - 8"	VIBRATIONS.
ORDINARY.	36,290	68,520	52.9%	20 %	4206
VANADIUM.	45,620	77,800	58.6%	23 %	12776

VIBRATION TEST ON ALTERNATING BENDING MACHINE. BAR HELD RIGID ONE END, OTHER END DEFLECTED $\frac{1}{8}$ " FROM EACH SIDE OF CENTRE.

passage through it of carbides (also illustrated) than does plain ferrite, thus rendering the Vanadium steels particularly suited to the great improvements conferred by judicious tempering, while it furthermore renders the tempering limitations wider. These two points assume great practical importance, as will be seen later.

Another portion of the Vanadium enormously strengthens the pearlite alloy, raising its elastic limit especially, and in addition promotes the cohesion of this alloy with ferrite. From these facts the explanation is readily seen as to why the strengthening effect of Vanadium increases rapidly as the proportion of elements other than iron (such as Carbon, Nickel, Chromium, Manganese, etc.) rises to the limits allowable in engineering steels, which limits are fixed by other considerations which it is needless for me to enter into to-night.

As illustrating the effects of Vanadium in increasing the static strength of material, the following table is appended:

Table No. 2.

Rolled Bars Untreated	Elastic limit	Ultimate tensile stress	Elongation on 2 ins.	Reduction of area
	Lbs. per sq. in.	Lbs. per sq. in.	Per cent.	Per cent.
Crucible Steels 0.20% Carbon				
Plain Carbon-manganese.....	35,840	60,480	35	60.0
“ +0.5 per cent. chromium.....	51,296	76,160	33	60.6
“ +1.0 “ “	56,000	85,568	30	57.3
“ +0.1 “ vanadium.....	63,840	77,052	31	60.0
“ +0.15 “ “	68,096	81,760	26	59.0
“ +0.25 “ “	76,384	88,032	24	59.0
“ +1 per cent. chromium+ } ..	81,088	108,864	24	56.6
“ .15 “ vanadium } ..				
“ +1 “ chromium+ } ..	90,496	135,296	18.5	46.3
“ 0.25 “ vanadium } ..				
Open-hearth Steels 0.3% Carbon				
Plain carbon-manganese.....	39,648	72,128	34	52.6
“ “ +1.0 per cent } ..				
Chromium +0.15 “ } ..	77,056	116,480	25	55.5
Vanadium } ..				
Crucible Steels 0.2% Carbon				
+5% Nickel	58,240	94,080	24	50.0
“ “ +.25% vanadium.....	116,700	129,700	20.5	52.4

The next table needs no amplification in illustration of the toughening effect of Vanadium with reference to oft-repeated strains, as shown in the progression of the various dynamic tests given in it.

Here may be said what is now generally recognized, that it is not lack of successful resistance of steel to one steadily applied strain which causes that steel to fail in the huge majority of instances, but rather its steady deterioration under the demoralizing effect of strains which, though in themselves very much less severe, are continually repeated. A true factor of safety can only possibly be arrived at both from consideration of the useful strength of the material (which useful strength, be it noted, is represented by the elastic limit and not by the ultimate stress required to break the metal) and its ability to withstand deterioration under repeated stresses and strains, both statically and dynamically applied. The absolute pre-eminence of Vanadium steels in resisting such deterioration has been thoroughly established as the result of many thousands of dynamic tests made under all kinds of conditions, which superiority is easily deducible from, and explainable by, the microscopic illustrations already shown.

Table No. 3 also illustrates the high combinations of static and dynamic excellence obtainable by oil-tempering the Vanadium compound steels, while table No. 4 illustrates the great effect of Vanadium on the improvement in strength due to oil tempering.

By reason of the many different ways in which Vanadium can act it has been truly called "A King" amongst alloys, ultra-static, ultra-dynamic or combined static and dynamic high degrees of excellence being attainable as shown in table No. 3.

This table also illustrates in detail machinery steels which will be of special interest to you to-night. The next tables will enumerate some of the leading types of Vanadium steel in general use and the applications to which these various steels are put. Type "A" and its milder variants, "B" and "C," have already been sufficiently spoken of.

The tempered type "D" steel is exceptionally suited for the manufacture of springs, as will be seen from the diagram

Table No. 3.

RESULTS of MECHANICAL TESTS of TYPICAL VANADIUM & OTHER STEELS

SHOWING HOW THE ALLOY VANADIUM CAN BE USED TO ATTAIN - STATIC SUPER-EXCELLENCE, DYNAMIC - SUPER-EXCELLENCE, OR COMBINATIONS OF BOTH.

AUTOMOBILE PURPOSES ARE TAKEN OWING TO REQUIREMENTS OF SAME BEING OF THE MOST EXIGENT NATURE

TEST	¹ CARBON AXLE STEEL	² NICKEL AXLE STEEL	³ VANADIUM AXLE STEEL TYPE A, 1911	⁴ VANADIUM CRANKSHAFT STEEL TYPE A, 1912	⁵ VANADIUM GEAR STEEL CRANKSHAFT TYPE A, 1912	NATURE -
YIELD POINT - LBS. PER SQ. IN.	41,330	49,270	63,570	110,100	224,000	STATIC
ULTIMATE STRESS TENSILE STRENGTH IN LBS. PER SQ. IN.	65,840	87,360	96,080	127,800	232,750	
RATIO -	62%	56%	66%	87%	96%	
ELONGATION ϵ_n 2'	42%	34%	33%	20%	11%	
CONTRACTION OF AREA	61%	58%	61%	58%	39%	
TORSIONAL TWISTS.	2.6	3.2	4.2	2.5	1.8	INTERMEDIATE
ALTERNATING BENDS	10	12	18	10	6	DYNAMIC
PENDULUM IMPACT FOOT POUNDS.	12.3	14	16.5	12	6	
ALTERNATING IMPACT NUMBER OF STRESSES.	960	800	2,700	1850	800	
FALLING WEIGHT ON NOTCHED BAR, HURDLE TEST.	25	35	69	76	—	
ROTARY VIBRATIONS NUMBER OF REVOLUTIONS.	6,200	10,000	67,500	—	—	

ALL FIGURES OBTAINED UNDER COMPARATIVE CONDITIONS.

illustrating the results of comparative tests of "Vanadium" and "Carbon" steel railway springs made by an independent examiner. These springs were 16-leaf locomotive springs made to a standard design. It may be said that a new "carbon steel" spring was tested, but that the Vanadium steel spring tested had already been subjected to gross distortion; its great superiority, however, even under the circumstances, is amply demonstrated. Variants of this class of steel in a softer condition than that pertaining to a spring are particularly applicable to the preparation of rails, tires, solid wheels, etc., a metal of great strength, high resistance to shock, impact, repeated stresses and of a structure highly resistant to abrasion (illustrated) being attainable by direct means.

Time will not permit me to go in any semblance of detail into the subject of case-hardening. As the object of case-hardening is to obtain an article which, although it has an exceedingly hard surface, at the same time shall have a tough resistant core, it naturally is inadmissible to case-harden any steel which in itself "takes a temper" as the result of quenching. The great increase in strength due to quenching mild Vanadium steel is illustrated in table No. 8 and its power of toughening carbides has been dealt with.

Table No. 4.

Static improvement due to Oil Tempering Carbon and Vanadium Steels.

CRUCIBLE STEEL	Elastic Limit Lbs. Per Sq. In.	Ult. Tens. Strength Lbs. Per Sq. In.	Elongation % on 2 inch	Reduction Area %
*Carbon Steel as Rolled.	61100	82700	24	49.7
" " Oil Tempered ...	71460	91800	17	52.3
Chrome Vanadium Steel as Rolled	90500	135300	18.5	46.3
" " Oil Tempe'd	141000	147000	17	57.0
Nickel Vanadium Steel as Rolled	116700	129700	20.5	52.4
" " Oil Tempered	179900	185300	14.5	50.5

*N. B.—The Carbon Steel was made in the crucible from a Swedish "base" and therefore shows higher results than would be expected in ordinary open hearth practice.

Table No. 7.

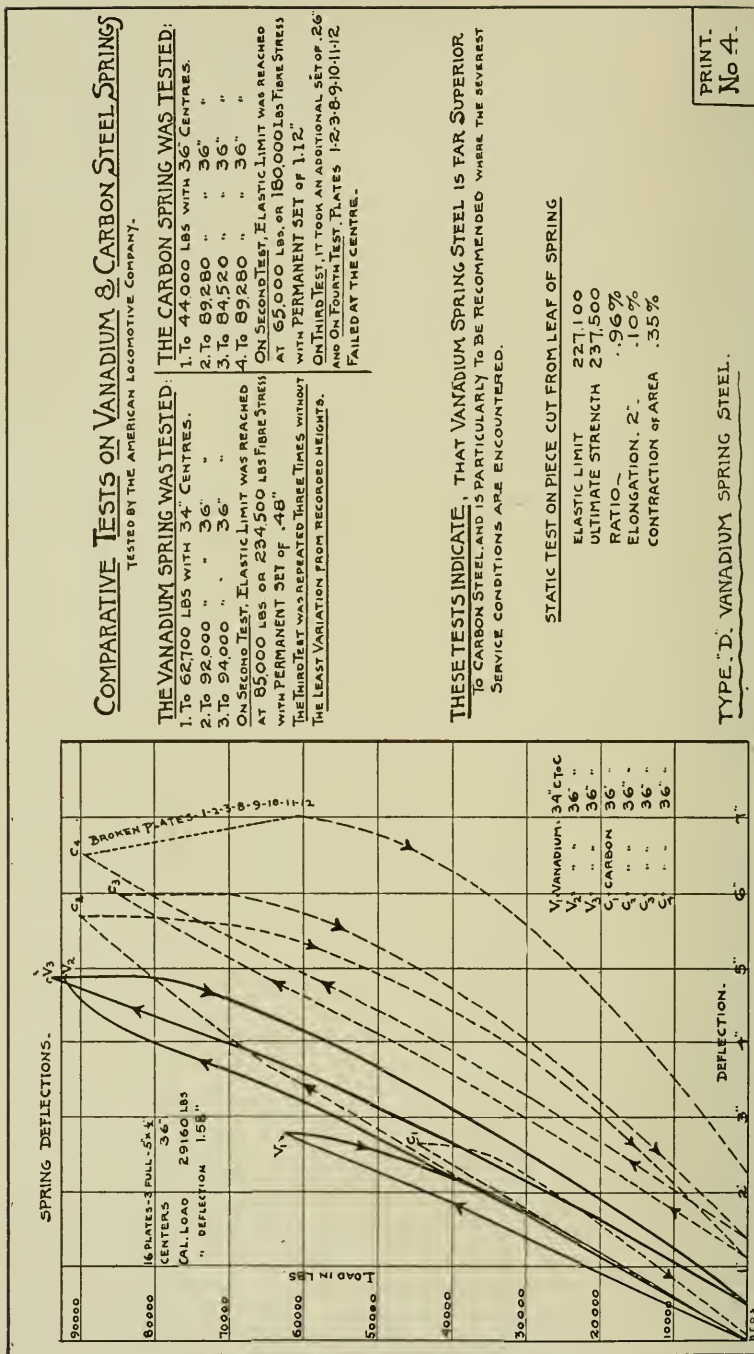


Table No. 8.

	Vanadium low Carbon Steel as rolled.	The same steel quenched in water from 850° C
Elastic Limit (Lbs. per sq. inch) }	44790	78390
Ultimate Tensile Strength (Lbs. per sq. inch) }	55990	100800
Elongation on 2 inch.....	45%	22%
Reduction of Area.....	69%	60%

Taking advantage of these points, the outside carburizing and the quenching of special mild Vanadium steel leads to results which are unapproachable when combinations of resistance to wear, strength, and toughness are considered. The subject of case-hardening is one full of interest, and its various ramifications could only be dealt with successfully in a paper or series of papers specially devoted to the matter alone.

The specimens upon the table will illustrate practically some of the points which have been dealt with. Many aspects of the question have not been touched upon at all, but it is the speaker's hope that the subject has so far aroused interest amongst those present as to cause them to express themselves on any other lines in connection with the matter, when the questions raised shall receive due amplification.

PRESIDENT: Gentlemen:—My early training has, of course, equipped me to discuss the subject, "ironically speaking"; but as it would be unbecoming in the Chair to enter into the discussion, you will kindly excuse me. We would like, however, to have any number of people question Mr. Smith on the subject and bring out such practical points as may lead to the application of this alloy to practical purposes. I am not desirous to call on any one in particular, but we have with us an old-time blacksmith, and I would ask Mr. Thomas Lace if he will open the discussion.

MR. THOMAS C. LACE: In your first view on the screen I noticed some pieces that were bent together. That is easy enough to do. Did you ever make a test of opening those pieces?

MR. SMITH: Yes, very many tests have been made on vanadium steels in opening bends. One of those pieces shown

on the screen was bent close together, then bent back and bent close together in the other direction and then opened up again, before it failed, and then it just began to tear.

MR. LACE: You spoke of vanadium steel as an alloy steel. If I understood your paper aright, it was some kind of a wash placed in the steel to purify it, so that you could use any kind of iron to make steel instead of the best Swedish iron, or something of that kind.

MR. SMITH: Vanadium automatically removes these poisonous constituents, nitrogen and oxygen. It does that portion of the work at the expense of its going into the steel, and it removes them in the form of a fusible slag. *But the vanadium left in the steel is responsible for an enormous amount of benefit, too.*

MR. LACE: But this does not constitute an alloy steel. In an alloy of steel if you break a piece of the steel and subject it to chemical analysis, the vanadium is found in it during the analysis.

MR. SMITH: Yes, sir, and so it is in these vanadium steels. But not absolutely the total amount of vanadium put in, because a certain amount of the vanadium has vanished if it has had work to do in removing impurities. If you properly added vanadium to a steel that was perfectly de-oxydized, then the whole of the vanadium you have put in would be found in the analysis in the steel. But if you have had any cleansing work to do then a certain amount of vanadium is carried away in doing it.

MR. LACE: But on my understanding of your paper it is an oxydizing agent and forms a fusible slag.

MR. SMITH: No, a de-oxydizing agent. A certain amount goes off if there is anything to carry it. But if you have absolutely no oxygen and no nitrogen and can add vanadium under perfectly de-oxydizing conditions, the whole of the vanadium you put in the steel stops there. If there is any cleansing or scavenging, as much as is necessary to do that scavenging goes off in the slag, and the remainder stays in the steel.

MR. LACE: Another thing is this, you use vanadium in conjunction with nickel and chromium. Why?

MR. SMITH: For the reason I tried to explain in the paper, *i. e.* the cumulative effect of vanadium when you have got something for it to work with. It will do the work itself, but it will do very much better work if it has an assistant. For instance, you can get very high static tests with chromium, but the dynamics are very low. With vanadium you can employ so little chromium that you do not dynamically affect the steel but you can get the full static intensifying effect.

MR. LACE: The last question, how does it affect the specific gravity? This material you put in reduces the zone of attraction, you say it makes it more "dense."

MR. SMITH: Vanadium does not affect the specific gravity.

MR. LACE: Isn't it more brittle?

MR. SMITH: No, because vanadium ferrite is tougher.

MR. LACE: They say nickel is placed in steel to make it more dense. Now any material under contraction is more dense, but it is very brittle, and the reduction of temperature renders it more brittle. According to that theory in a temperature below zero it would not be trustworthy.

MR. SMITH: Vanadium steels are less brittle than ordinary steels because the ferrite is so much tougher and better. It is not a question of "density" in the literal sense of the word.

MR. F. J. REEVE: I would like to ask, provided you have a de-oxydized base to start with, so that a given portion of vanadium would not have to go off in the slag, if you could produce results in what we call tool steel that would equal the results obtained from so-called high speed steels in which we find tungsten?

MR. SMITH: We do not attempt to make vanadium replace tungsten, because the work of tungsten is almost entirely in the influencing of the behavior of these carbides, but vanadium does improve tool steel. There has been much vanadium tool steel made, and the chief advantage is in its peculiar toughening effect on the background. Speaking broadly, it is the carbide that does the work, but the background fails and does not "hold

up." The vanadium toughens the background and the background holds up and gives the better result. You can accentuate the action of tungsten by vanadium, that is to use less tungsten when adding vanadium.

MR. REEVE: Then with tool steel containing tungsten a portion of vanadium added to that steel would still help it further?

MR. SMITH: Much further. Quantities of tool steel are being made today to which vanadium is being added for that very purpose, and they are sold under different names. As we know, some of the very high grade tool steels can only be made with a certain grade of Swedish iron. If you take an ordinary iron and put vanadium in you get just as good results as using that high grade Swedish iron, and, in fact, better results.

MR. GEORGE S. BOWES: If you have a heat of steel ready to pour and already added your manganese, when do you add your vanadium?

MR. SMITH: That depends entirely on the steel process. As I said before, vanadium is an easily oxydized material; the oxide of vanadium is the radical of a true acid. Therefore, if you put vanadium in a basic furnace, the basic slag will take up the vanadium just like it will ferro-silicon. I add it in the ladle in the basic process; but in the acid process, where the slag is acid and will not take up vanadium in the same way, if you work your furnace down, deoxydize it, and then "blanket" your flame, you can add vanadium in the hearth two or three minutes before pouring.

MR. BOWES: Will you lose any vanadium that is not doing useful work?

MR. SMITH: A very small amount. It is in the province of the steel maker to de-oxydize the steel as much as possible, but he does not succeed in de-oxydizing it altogether. Vanadium is a very powerful de-oxydizer. If you could de-oxydize fully—in my experience you cannot absolutely—and add your vanadium, you would get the absolutely theoretical amount in the steel. Of course, if the vanadium is added carelessly or added in a powerfully oxydizing atmosphere, a lot of it would be oxydized that you don't want oxydized. But you can easily stop that. In ordi-

nary practice you practically de-oxydize the bath and add the vanadium, and you get about 85% of the vanadium added left in the steel.

MR. BOWES: Will you lose any of your carbon?

MR. SMITH: No.

MR. BOWES: What does it cost a pound?

MR. SMITH: \$5.00 a pound net, and it takes three to five pounds to influence any of the types of steel I have shown. Case hardening will take about three pounds and spring steel about five pounds.

MR. BOWES: In finished steel, for instance wire, how does the presence of vanadium affect corrosion?

MR. SMITH: I am glad you asked that question. As a matter of fact we do not pretend that vanadium steels are anti-corrosive, but we do know that oxydized steel will corrode very quickly, and with the oxygen worked out it will resist corrosion much more. With vanadium it will resist still more. To get true non-corrosion you must go outside of any steel we have spoken of tonight. Briefly and broadly you may say that vanadium steels resist corrosion like the best qualities of wrought iron, that is better than the ordinary type of open hearth steel.

MR. BOWES: What per cent of vanadium?

MR. SMITH: If you were going simply to fight the corrosion, I should not use more than 1 per cent. That would be about 2 or $2\frac{1}{4}$ pounds to the ton.

MR. H. E. WALTERS: The maximum quantity of vanadium in steel does not run over 25%?

MR. SMITH: About 25%. In the high grade tool steel we were speaking about it will run a little higher still, about 30 to 33 per cent, but in ordinary types of vanadium steel (any of the types I have been talking about tonight) you may say that the contents range between 15 and 25 per cent.

MR. WALTERS: In comparison of the micro-structure between nickel and vanadium steels, what percentage of nickel is in that steel?

MR. SMITH: The nickel in the nickel steels shown will run from $3\frac{3}{4}$ to $4\frac{1}{2}$ per cent.

MR. WALTERS: I was struck recently by that paper of Richards on chromium, nickel, cobalt. I think there the alternating stresses were very high with about $1\frac{1}{2}\%$ nickel steel.

MR. SMITH: Yes, they were high; but the alternating stresses were taken in a form of pure vibration machine where you get the fibre stresses very far below the elastic limit.

MR. WALTERS: As far as I can see the whole value of the vanadium in the steel at present is that it prevents the segregation of the constituents.

MR. SMITH: That is not the whole value, that is one of the many benefits; another lies in the absolute toughening of the steel, in the effect of the vanadium on the carbonless background.

MR. WALTERS: In other words, the vanadium goes into the solid solution of the ferrite?

MR. SMITH: Some does. Then more goes into solid solution in the pearlite. Pearlite in vanadium steel will consist of the carbides of iron, manganese and vanadium; and in a chrome-vanadium steel it will consist of the carbides of chromium, iron, manganese and vanadium.

MR. WALTERS: Of course, about this carbide of vanadium it is pretty hard to say. Has it been isolated at all?

MR. SMITH: Oh, yes.

MR. WALTERS: In the steel itself?

MR. SMITH: Yes, sir; and it is very easily done. Take a vanadium steel with a moderate amount of carbon in it. If you take a 35 carbon steel and dissolve a cylinder of it in very dilute acid over a period of several months with the aid of a galvanic current, you will not leave a particle of the ferrite and you will not throw out a particle of the carbon. A certain amount of vanadium is found in the carbides left, and a certain amount is found in the solution, showing that it existed in solid solution in the ferrite.

MR. WALTERS: Another question. Has vanadium been used for a cast iron?

MR. SMITH: Yes, and is being used.

MR. WALTERS: Do you think it will do as much good there as in steel?

MR. SMITH: It cannot do as much good because, though all steel are non-homogeneous materials, still compared with grey cast iron they are very homogeneous. Grey cast iron contains flakes of graphite in the iron, and no alloy can affect the quality of that graphite. The chilled portion of the iron is cementite, and vanadium will help that very much. There have been some rolls working here made of vanadium iron chilled, and they gave just three times the amount of ordinary wear.

MR. WALTERS: Most of those alloys that they use in steel do not work the same in cast iron in the chilling. The manganese has an effect in the steel and it does not have the same effect in the cast iron.

MR. SMITH: Manganese works in just the opposite way, as I tried to show you on the screen.

MR. WALTERS: But every text book you pick up tells you it does not. Were these micro-specimens etched with alcohol?

MR. SMITH: These were all etched with alcoholic solutions. I never let water touch my specimens and think that is how I have been so lucky in differentiating crystal boundaries.

MR. J. C. WARNE: I would like to ask Mr. Smith if this has been used on steel tires, car wheels and steel wheels?

MR. SMITH. It is now being tried.

MR. WALTERS: I think chemists would be mostly interested in knowing how it is analyzed.

MR. SMITH: That is a very simple proposition and I would be very glad to give anybody the methods I have used in the past ten years in analyzing vanadium. Mr. Uhler can tell you something of that.

MR. J. L. UHLER: I do not know that I can explain very much about the way of analyzing excepting that in chrome-vanadium steel the knack is to take the titration point between the chromium and the vanadium.

MR. SMITH: That is the whole thing. Vanadium analysis is not difficult to make; it is only difficult in the sense that it is tricky. My old junior assistants seldom took more than 40 minutes in volumetric vanadium estimation in steel. If you use the color method that I have published in a good many journals you can do it easily in nine or ten minutes.

MR. UHLER: It only comes with experience; the more you do it the quicker you can do it. If you are only doing it once in a while a man will flounder every time.

MR. SMITH: He will either find much less vanadium than there is or he will find more than you put in. (Laughter.)

MR. UHLER: In my own experience I took three or four drillings out of the same sheet and I got three or four different results at first. After that I figured that the more I did the better results I got out of it. Finally I got out to a point where the results that were obtained were correct.

MR. SMITH: A good many works in this state are now making vanadium steel and there are several chemists who now get absolutely correct results. All tests depending on a color finish must be more or less tricky until you get experience.

MR. B. F. WESTON: I would like to ask the gentleman to what he attributes the value of this alloy of vanadium, to the purification of the steel or to the influence per se.

MR. SMITH: To both of them, certainly. Vanadium does some of the useful work by cleansing, but it does not finish there. It cleanses by removing the oxygen and the nitrogen, but it does the majority of its work by solution. The proportion of the two amounts of good that it does cannot positively be said, for the simple reason that that is entirely dependent upon the amount of scavenging the vanadium has to do.

MR. WESTON: You say vanadium reduces nitrogen. Wouldn't titanium do that?

MR. SMITH: It will do the same thing. But your titanium is only going to be good for scavenging, nothing else. And, as I said before, you do not know how much scavenging you have to do. You may use a lot more titanium than is necessary to do the scavenging, and what is left, above what is necessary for

scavenging, is not anything to the good, rather the reverse, while the product of the scavenging is very refractory.

MR. WESTON: Why not let a cheaper material do part of the scavenging and finish with vanadium?

MR. SMITH: That is quite right, and that is why I always advocate adding the vanadium to the best quality of steel you can possibly get.

MR. WESTON: Supposing you add 5 to 10 per cent to steel, what is the effect?

MR. SMITH: You make it too hard. You have got beyond the useful limit. On this point, outside commercial consideration, I would allude to the excellent published work of Mr. Guillet.

PRESIDENT: This is certainly very interesting, but the hour is growing late and we have some other entertainment to follow. We hope all will remain.

MR. J. D. McILWAIN: I think this Club has had something tonight worthy of their steel, in this discussion. I think this is almost the first time when the speaker was able to answer all the questions, and I think it is worthy of a vote of thanks. I move, therefore, that a vote of thanks be extended to Mr. Smith for the splendid paper and the way in which it has been presented to us.

The motion, being duly seconded, was carried unanimously.

PRESIDENT: We have had such a delightful time this afternoon and the arrangements made by the Committee were so complete in detail that it has really set some of our people to thinking. During the afternoon it was suggested that instead of having our annual smoker we have a banquet and include the ladies. What is the pleasure of the Club?

MR. REEVE: I think that suggestion will meet with the favor of a good many of the Club, and I move the President appoint a Committee to take this matter in charge.

The motion, being duly seconded, was carried.

PRESIDENT: While this, perhaps, properly comes under the care of the Executive Committee, still it is quite difficult to

get all the members of the Executive Committee together, and we will take the liberty of appointing this Committee, which shall map out the plan and details and submit their report to the Executive Committee for approval. And I will appoint as that Committee Messrs. Geo. T. Barnsley, W. A. Terry and D. M. Howe, and will expect them to carry out the wishes of the Club in quite an elaborate manner and as successfully as was the affair this afternoon.

MR. F. T. HYNDMAN: I have a word to say before we adjourn. It has been a great pleasure to me to be here this evening and listen to the very interesting subject which has been so ably presented by Mr. Smith. It is also pleasing to me to see the interest taken by the members, which is so clearly demonstrated by the large attendance this evening. I sincerely hope that the Railway Club of Pittsburgh will continue to grow until it ranks in numbers and in ability among the very highest Railway Clubs in the United States.

PRESIDENT: We assure Mr. Hyndman that we are very glad to have him with us, and we hope that he will come as often as he can.

ON MOTION, Adjourned.

In Memoriam.

W. J. MARTIN

W. J. MARTIN, *Chief Clerk to the Superintendent of Motive Power of the Pittsburgh, Shawmut and Northern Railroad, and a member of this Club, died at his home in St. Mary's, Pa., April 30, 1907, at the age of forty-two years.*

He entered railway service at an early age, having served in the employ of the Baltimore and Ohio and Illinois Central Railroads previous to his connection with the Pittsburgh, Shawmut and Northern Railroad. In railroad circles he was regarded as a very capable man, and he will be greatly missed by his many business associates and personal friends.

As a Club we mourn his loss, and direct that a copy of these proceedings be placed upon the Club records, and that a copy be sent to his bereaved family as a testimonial of the esteem in which he was held by the Railway Club of Pittsburgh.

GEORGE P. BROWN,
A. D. CHITTENDEN,
F. J. REEVE,
Committee.

SOCIETY OF RAILWAY CLUB SECRETARIES.

MEETING AND DINNER

JUNE 15, 1907.

The annual meeting of the Society of Railway Club Secretaries was held at the Hotel Marlborough-Blenheim, Atlantic City, N. J., Saturday, June 15, 1907, at 2 p. m. Present:

John D. Conway, Railway Club of Pittsburgh, Chairman.

James Powell, Canadian Railroad Club, Vice-Chairman.

Harry D. Vought, Central Railway and New York Railroad Clubs, Secretary-Treasurer.

Daniel M. Brady, Honorary Member.

E. L. Janes, New England Railroad Club.

F. O. Robinson, Richmond Railroad Club.

On motion of Mr. Janes, the minutes of the annual and semi-annual meetings having been distributed to the members, the reading thereof was dispensed with.

The Secretary-Treasurer reported that arrangements had been completed for the annual dinner to be held in the evening and that the prospects were favorable for 40 or more guests.

The Secretary-Treasurer presented the following financial report:

Officers and Members of the Society of Railway Club Secretaries:

In making his annual report your Secretary-Treasurer regrets it is necessary to say that our organization reaches another mile-stone in its history with diminished numbers. This is due, first, to the terrible disaster at San Francisco last April which had the effect of depriving our brethren on the Pacific slope of their organization and the Pacific Coast Club lost its life.

The Southern & Southwestern Club, which seems to have lapsed into a state of apathy, ceased to have any power of attraction or vital interest in the work of organized effort along the lines that have made railway clubs of practical usefulness and corresponding value. It is understood that efforts have been made to galvanize it into life, as a result of which meetings have been held and officers elected, but with what result your Secretary-Treasurer is not advised. It is a fact, however, that there has been no disposition to maintain affiliation with this Society;

and for obvious reasons, which need not be dwelt upon here, the Club, so far as we are concerned, is without being, and its name has been dropped from our roll.

One year ago the North-West Club, unfortunately, relapsed into a condition where it could not, reasonably, continue the publication of its Proceedings. While, possibly, meetings have been held since that time there is no published record of the fact, and its Secretary has officially suggested that it be treated as having passed out of existence. Its assessment for the past year remains unpaid, as does that of the Southern & Southwestern Club and likewise that of the Pacific Coast Club. It is a matter for further regret that the North-West Club accepted its proportion of the Index of Subjects published by this Society and ordered a sufficient number of copies to supply its members. Your Secretary-Treasurer has, therefore, advised its Secretary that under the circumstances it seemed no more than fair that its assessment should be paid and has asked that the amount be remitted. No reply to this request has been received.

Although we have, seemingly, lost strength, it would appear to be only in numbers. It is a trite saying that "there is no loss without some gain." In this instance it is seemingly to the advantage of some, if not all of us. Fewer clubs are in the field to draw upon those sources of revenue which have contributed so much to the life of our respective organizations and made it possible for railway clubs to successfully perpetuate the important, as well as valued practice of issuing the Proceedings of their meetings in printed form. It is needless for me to dwell upon the significance of either this phase of the situation or the suggestion it offers as to the possibilities to be expected if all of us were rendered incapable of carrying on this work.

The railway club that has poor literature, or worse still, no literature at all, cannot expect nor hope to maintain a useful existence. The canker worm of disintegration has attacked its vital parts and it becomes only a question of time, indeed a very short time, when its spark of life will be extinguished. We need not look for explanatory causes or reasons. They are, as a rule, so clearly in evidence that deductions may be readily reached in undertaking to analyze the situation and answer the

inquiry as to why any club should lose prestige, strength and influence.

It has seemed to me that as we examine into this there must come to each and all of us a signal of warning. It is of greater force than, possibly, may for the moment force itself upon our thought and attention. Yet it needs but brief reflection to indicate that it involves a lesson we need to take home to ourselves and ponder upon.

Disclaiming the slightest desire or intention to give offense or wound any individual, will you pardon me for giving expression to thoughts that crowd themselves in upon my mind as I studied the subject of one or more clubs losing ground and going to pieces. The father of this Society, Mr. Daniel M. Brady, once said within my hearing: "A Secretary makes or unmakes an organization." Perhaps this would seem to be putting it very strongly and some might say attaching undue credit and importance to one office and the individual occupying it. If you gentlemen, however, will only give it fair and deliberate thought, you will find that there is a large element of truth in the assertion; that it has really a substantial foundation.

A club may have good or bad officers, it makes no difference which, if the Secretary is equal to the exacting and multiple demands of his position. If he is conscientious, vibrant with appreciation of his duty, full of enthusiastic desire to be faithful and efficient, and ambitious to, at least, *try* to be equal to the responsibilities connected with his work, and so inspire zeal, vital energy and strong determination among the members, the organization must live—it cannot fail. There may be periods when unavoidable circumstances may interfere—but it will be only a temporary interruption. There will still be in reserve a latent force and recuperative power which only needs to be brought into operation to absolutely eradicate the things that threaten decay.

The Secretary is on the job morning, noon and night, if heart and soul are concerned in the promotion of the welfare of the Club; he lives with it, he sleeps with it, and it is even the moving spirit of his dreams. He is like the faithful sentry or picket, constantly on guard, keenly alive to every emergency, ever alert, never relaxing vigilance.

True, he is entitled to encouragement and support from those to whom he is directly responsible, but whether he gets it or not, it is his imperative obligation and his stern duty to be all that has been here mentioned. The chief source of reward and satisfaction for him is the consciousness that he has not been remiss and that the organization he serves is a leader, a moulder of thought and opinion, an educator, a great power for good to the many in the great and important field it occupies.

The Secretary who is not mindful of all these requisites is putting himself in jeopardy quite as much as the organization to which his services are given. He is not honest, either with himself or that organization, and is a positive hindrance to its success and perpetuity.

This subject is susceptible of further elaboration and tense argument, but its pursuit is unnecessary beyond the limitations here reached. Please bear in mind that what has been said has been only in the very kindest spirit. May it help to put us on our mettle so that as we look back upon our records, or survey the future with the knowledge that our clubs are examples of energized practicality, it may be said of each one of us when we lay aside the burden of life: "Well done, good and faithful servant."

Probably the best that can be said of our special meeting is that it served to give those who attended a pleasurable opportunity for greeting one another that would not otherwise have been afforded and to participate in the interesting features of a meeting held at that time by one of the clubs enrolled in this society. There was not much in the way of serious business to take our time beyond preliminary arrangements for our meeting today and the annual dinner to be served tonight. With regard to the latter event, if each individual secretary will take hold of the matter in the right spirit and strive to imbue the officers of his club with some of his own enthusiasm, it must, ultimately, become one of the most delightful social features of the annual conventions of the Master Car Builders and Master Mechanics. Possibly some salutary results will flow from it which will be to the direct advantage of the club we represent. The latter, of course, should be the chief object in view, and its achievement is worthy of our earnest effort and co-operation. If united and

determined, every undertaking for the good of the individual clubs that engages our intelligent consideration must be crowned with success.

Appended is a statement of the financial affairs of the Society:

RECEIPTS.

Balance on hand June 15, 1906.....	\$ 65 03
Cash subscriptions for the annual dinner.....	\$40 00
Assessments paid by nine clubs.....	90 00
	<hr/>
	130 00
	<hr/>
Total.....	\$195 03

DISBURSEMENTS.

For annual dinner.....	\$71 50
For printing Index of Subjects.....	85 00
For miscellaneous printing.....	3 00
For stenographer	5 00
For stationery	2 00
For postage, etc.....	5 00
	<hr/>
	\$171 50
	<hr/>
Balance.....	\$ 23 53

Respectfully submitted,

HARRY D. VOUGHT,

Secretary-Treasurer.

On motion of Mr. Powell, the report was received, approved and ordered entered upon the records with thanks to the Secretary-Treasurer for the same. It was also ordered that this report be read at the dinner in the evening.

The following letter from Mr. B. W. Benedict, Editor, "Railway Master Mechanic," was received and, on motion of Mr. Powell, ordered referred to each individual club with a recommendation for the adoption as far as practicable, of the suggestions made.

Chicago, March 6, 1907.

Mr. Harry D. Vought,

Secretary, New York Railroad Club,

New York City.

Dear Sir: I am forwarding you under separate cover a copy of the March issue of the Railway Master Mechanic and

request your consideration of an editorial on "The Designation of Subjects in Railway Club Proceedings." The article was published in the hope of showing the necessity of a more uniform method of designating subjects on the covers of the monthly Proceedings of the various railway clubs, in order to make them more convenient for reference.

With a few exceptions, club Proceedings are not arranged for convenience in filing and reference, which is a decided disadvantage. It is believed that this should be changed, and by a little concerted action, a uniform method in designating subjects on the covers of all railway clubs decided upon.

After reading the editorial any suggestions you have to make in regard to your own club Proceedings and what course you would advise in considering the proposition as a whole would be appreciated.

Very truly yours,

B. W. BENEDICT,
Editor, Railway Master Mechanic.

Des Moines, Iowa, May 27, 1907.

Mr. Harry D. Vought,
Secretary, New York Railroad Club,
New York City.

Dear Sir: I regret very much my not being able to be present at the meeting and dinner June 15th. I feel I am missing much from the glowing report our worthy President gave of the last meeting. I know you will have another at this time.

With best wishes for the success of the occasion, I remain,

Very truly yours,

W. B. HARRISON,
Secretary, Iowa Railway Club.

Buffalo, N. Y., June 25, 1907.

Mr. Harry D. Vought,
Secretary, Central Railway Club,
New York City.

Dear Sir: I was very sorry that I couldn't get down to Atlantic City to take in the meetings and attend the banquet of the Society of Railway Club Secretaries, but it was absolutely impossible for me to be there. I was glad, however, that Mr.

E. M. Tewkesbury was able to be on hand. He said he had a very interesting and enjoyable time.

I suppose the fact that I, as an official of the Central Railway Club, was unable to eat and drink what was called for by the face of the ticket you sent me, does not release me from paying the bill, and I, therefore, send you three dollars herewith and hope that the Railway Club Secretaries' Association will have a long and successful existence and perform some material good for the railroad world in general.

Very truly yours,

GEORGE W. SMITH.

Second Vice-President, Central Railway Club.

Des Moines, Iowa, June 8, 1907.

Mr. Harry D. Vought,

Secretary, New York Railroad Club,
New York City.

Dear Sir: I very much regret that I shall be unable to meet with the Railway Club Secretaries on the 15th inst., as I had planned and desired. I feel that you will appreciate and excuse me on this occasion when I state that my first born graduates from the State College and his mother feels, as does the boy, that the "old man" ought to be there to see him properly launched into the world. It may be possible that my presence will prevent him from going off with such a jump that it would jar or in any way disturb the meeting down there at Atlantic City or cause a tidal wave, which would interfere with the pleasure of the banquet board.

I did not realize that these dates would conflict or so closely conflict, Thursday being the important day, that it would prevent my being in both places, until a day or two ago.

I recall with great pleasure the meeting last year and regret that I shall not have the opportunity of renewing acquaintances made at that time. There is no great loss without a corresponding gain, however, and you are to be congratulated that you escape the speech which I have been "incubating" lo! these many days, and really thought that I had successfully pulled through the pin-feather period for a successful flight on the 15th.

Will you please give my regards to those good fellows whom

I met a year ago and express my regrets because circumstances prevent my presence at your banquet board.

With kindest regards I am,

Very truly yours,

E. M. WENTWORTH.

New York, June 10th, 1907.

Mr. Harry D. Vought,

Secretary, New York Railroad Club,

New York City.

Dear Sir: I thank you very much for your kind invitation to speak at the dinner of the Club Secretaries to be given at Atlantic City on Saturday next, upon the subject named, but I must insist that you excuse me, as in the first place it is doubtful whether I shall be able to attend the meeting, and anyhow, I would not care to discuss the subject.

I should enjoy sitting down with you gentlemen and your subscribing friends and eating a good dinner, *but I won't talk this time*. I am surprised that you do not give heed to the forcible advice given by the Father of your Society, when he said, the time we met in Mr. Besler's office: "Get some men of strength and influence to talk—not George Post or me—we are chestnuts."

Verily, you will add greatly to the pleasure of the boys at your dinner party if you will give them a rest from Brady—and—Post. Put a muzzle on Brady—and—me, and many will rise up and call you "blessed."

Very truly yours,

GEORGE POST.

The letters of Mr. Wentworth and Mr. Post were ordered read at the annual dinner.

Mr. Powell stated that his Club was desirous of having the Society consider a uniform method of bookkeeping and blank forms for advertising contracts, etc.

After some discussion, the matter, on motion of Mr. Brady, was referred to Mr. Janes and Mr. Vought as a Committee of two to prepare recommendations for the next meeting of the Society.

On motion of Mr. Janes, it was agreed to hold a semi-annual meeting on the third Saturday in January, 1908, at 10 a. m., in New York City; also that the annual assessment upon the Clubs for the expenses of the Society be fixed at \$10.00.

Election of officers resulted as follows:

Chairman, James Powell, Secretary Canadian Railway Club.
Vice-Chairman, F. O. Robinson, Secretary Richmond Railway Club.

Secretary-Treasurer, H. D. Vought, Secretary Central and New York Railway Clubs.

On motion of Mr. Powell, the thanks of the Society were given to the retiring Chairman and the Secretary-Treasurer for the efficiency with which they had done their duty; also complimenting them upon the continued success of the organization, which, Mr. Powell said, was to be largely attributed to their work.

Mr. Brady said he cheerfully seconded the motion of Mr. Powell as well as the sentiments which inspired the same.

Mr. Conway, in responding to the same, said that if what little he had been able to do had been of any benefit, he was content and there was no occasion for regret. He felt that the organization was in good hands for the ensuing year and its work would be perpetuated in a manner that would be creditable to all concerned.

On motion of Mr. Powell an appropriation of \$10.00 was authorized to pay for stenographic work done for the Secretary.

There being no further business, the Society adjourned.

FROM LABOR TO REFRESHMENT.

The annual dinner of the Society of Railway Club Secretaries was held at the Hotel Marlborough-Blenheim, Atlantic City, N. J., Saturday evening, June 15, 1907, at 7 p. m., Mr. Conway officiating as toastmaster. Among those who participated, in addition to the Secretaries heretofore named, were the following:

W. G. Besler, of New York, Vice-President and General Manager of the C. R. R. of N. J., and Second Vice-President of the New York Railroad Club; William McIntosh, President-

elect of the American Railway Master Mechanics Association; Daniel M. Brady, President of the Brady Brass Company; William B. Albright, Chairman, Finance Committee, New York Railroad Club; F. H. Stark, President of the Railway Club of Pittsburgh and Superintendent of the Pittsburgh Coal Company; R. F. McKenna, Master Car Builder of the Lackawanna and First Vice-President of the Central Railway Club; Charles H. Hogan, Depew, N. Y., Division Superintendent of Motive Power, N. Y. C. & H. R. R. R. and Ex-President of the Central Railway Club; H. S. Hayward, Superintendent of Motive Power of the Pennsylvania Railroad and Third Vice-President of the New York Railroad Club; Frank Hedley, General Manager, Interborough Rapid Transit Company and Executive Member of the New York Railroad Club; Charles Waughop, of the St. Louis Club, Chief Interchange Inspector of all lines at St. Louis and East St. Louis; J. F. Walsh, Richmond, Va., Superintendent of Motive Power of the Chesapeake & Ohio and a former President of the Richmond Railroad Club; George A. Post, President of the Standard Coupler Company; W. F. Bussey, Chief Clerk, Motive Power Department, B. & O. R. R., Baltimore; E. M. Tewkesbury, General Superintendent, South Buffalo Railway, Buffalo; C. J. Phillips, Superintendent of the Lackawanna Railroad; James Ogilvie, Inspector for the Canadian Railway Commission; Amos H. Watts, Master Mechanic, Cincinnati Northern; Hugh M. Wilson, President of the Wilson Company, Publisher of the Railway Age; D. C. Noble, of the Pittsburgh Spring & Steel Company; F. C. Cleaver, Superintendent of Motive Power and Rolling Stock of the Rutland Railroad, Vermont; T. R. McFeatters, United States Metallic & Packing Company; Charles A. Lindstrom, Pressed Steel Car Company, Pittsburgh; W. S. McGowan, American Brake Shoe & Foundry Company; R. H. Blackall, Westinghouse Air Brake Company, Pittsburgh; R. K. Reading, Superintendent of Motive Power of the Pennsylvania, Buffalo; H. S. Haywards, Jr., of the Franklin Manufacturing Company; Clarence Hayward; F. McD. Quinn, Tourist Agent, Pennsylvania Railroad; Elhart C. Adams, and George L. McCabe, of the Garlock Packing Company.

Responses to impromptu toasts were made by Messrs. Besler, McIntosh, Walsh, Phillips, Cleaver, Hogan, Stark and Powell.

Mr. Besler in opening his address said that the work of

railway clubs had been a means of education to many men, and, therefore, the good influence of these associations was worthy of the greatest encouragement.

It had been a matter of some surprise for a man in his position to so actively indentify himself in an official capacity with railway clubs and a disposition shown to question the good policy of his associating himself so closely with subordinates.

His answer as to this was that he had never been afraid of having so many smart men about him that he would be in danger of losing his job. He was glad to have them in positions for their intelligence and competency and the exhibition of it.

He made it a rule never to ask men to go where he would not go himself. If he gave a man a task he was always willing that he should begin and finish it. It tended to prove his fitness, and if he was unequal to the undertaking the quicker it became known in a decisive way the better for the property and the managing officers. A man's engagement and work is easy if he has good subordinates. Not much can be expected of a man who is held down, and not given a chance to show what is in him. It was preferable for him that a man be allowed to do a piece of work as best he knows how and he will strive to do it well, because there is hope for such a man and for his ultimate development and improvement.

Mr. Besler deplored the present remarkable inefficiency of many in the rank and file of railroad employes. There was, he said, wonderful unrest and lack of sympathy between corporations and their men. The latter were no longer proud of speaking of the company as "our company," of the shops as "our shops," and of the work they were doing and of being a part of the organization. The disposition is now to see how much they can get out of the company and to be against the organization. Labor leaders were furnishing bad examples, and precepts were being taught by false teachers. Recently a gleam of sunlight and a ray of sanity had appeared where, formerly, there was a darkened sky and there appeared to be no longer a square deal for those in control and expected to get results.

Mr. Besler continued that his remarks were personal and those to whom he addressed himself were at liberty to differ

with him. Speaking of railroad clubs, he said they were built on educational lines for the uplifting and upbuilding of men. An individual might be so green that the cows might eat him, but if connected with these organizations where he would touch elbows with his superiors he would begin to improve and better himself. Every man should be encouraged along these lines for the beneficial results obtained. In a number of instances the work of these clubs had had the effect also of educating them back to first principles and conditions of the past where they felt a pride in being a part of the organization. Papers presented at club meetings were highly valuable in the part they played in the matter of education, and, ultimately, gave men an insight into matter of which they, personally, might have been ignorant, with the result that in time they were qualified to discuss the subjects dealt with.

Reverting to his former connection with the St. Louis Superintendent's Association, which had amalgamated with the Railroad Officers' Association of that city, and to mistaken forms of discipline, Mr. Besler said that during that period he advocated more humane treatment of men, because of the more salutary results obtained. He reiterated such sentiments at this time. It would, he thought, have the effect of bringing back the millions of men who had been weaned from corporations until they presented such a solid front to the country that there would be less disposition to engage in such anti-railroad legislation and regulation as had been recently known. These men would say to legislators: "You may theorize, but you don't know our business." The disappearance of the full dinner pail and the prevalence of too many men for one job would tend to bring men to their senses, but railroad clubs and kindred organizations could do much to avert such a condition. There should be willingness to discuss this matter and create a sentiment and influence that would permeate the rank and file, until the men were so imbued with a proper appreciation of their relation to the company that they would be ready to make any sacrifice rather than be disloyal to the corporation.

These men, Mr. Besler added, are children and need discipline. We are considerate and mindful of the good of our own children and too blind to the faults in them, while quick to see

the flaws and misconduct in the children of others, so, therefore, we should keep these things in mind when dealing with men.

The work of club secretaries, Mr. Besler believed, was much appreciated. Their places were hard to fill, and they were the right men in the right places. Undoubtedly it was true that the making or breaking of an organization could often be traced directly to the kind of man occupying the position of secretary. The secretaries were entitled to kindly and cordial support in all laudable undertakings.

President Stark of the Pittsburgh Club in responding to an invitation from the Chairman to speak said that he had come up through the ranks, and one of the proudest honors he had ever achieved was in being elected President of the Railway Club of Pittsburgh. He esteemed it a high privilege to be present with the Secretaries at their annual dinner, and he hoped he would be invited to do so again after his term of office had expired.

Addressing himself to the question as to whether there is any reason why a railroad man should not belong to a railroad club, he said that all ambitious and progressive men connected with railroads who are eligible should, by no means, forego such membership when it was possible for them to be identified with such organizations. While the published Proceedings of the Clubs were of benefit it was better still for them to attend meetings and to qualify themselves to participate in the discussions, as well as to listen to them. While the reading of papers and discussions as published was beneficial, to hear these in person was much more so. Railroad officials should, therefore, encourage their men to become members of a club and attend its meetings.

Mr. Stark believed that the railroads could well afford, therefore, to make appropriations in support of the clubs out of consideration for the splendid educational benefits accorded to their employees. He believed the time would come when corporations would do this. He advocated officers of railroads allying themselves with railroad clubs and coming in contact with their men at the meetings, because it tended to establish a bond between themselves and their subordinates and a mutual recognition of the relationships sustained which could not be gained in any other way.

Mr. Stark expressed the opinion that managers had failed to properly appreciate the mechanical end of railway service, but they were beginning to do so in a promising way, and the club organization was bound to correspondingly improve.

Secretary Powell, of the Canadian Club and Chairman-elect of the Society, who spoke next, said that, while he came from Canada, he did not feel that he was strictly a foreigner among the men identified with the mechanical branches of railway service. Neither did he feel that he was among strangers, for many of these present had become known to him across the border. Members of the Canadian Club took just as much interest in the affairs of railroads in the United States as they did in those of Canada. Mr. Powell had been much impressed with what had transpired in the convention of the Master Mechanics in relation to the apprentice system, especially that of the New York Central, and he, personally, was much interested in young men. He realized that, however much had been accomplished, there was much more to do in the future, and the manner in which it was developed depended on how the young men of the present are prepared for the responsibilities of the future. Therefore it was important to train men up in the way they should go and encourage in them activity and contact with men of practical ideas. Mr. Powell believed there was need of the masters being more in touch with their subordinates, for they would be the better able to readily discourage their becoming connected with organized labor.

As for the Railroad Club Secretaries, Mr. Powell believed they were doing their work to the very best of their ability. They had a hard task to perform and needed the support of leaders among railroad men in their efforts to promote the best interests of the Club, without which success could not be fully obtained.

Mr. Charles H. Hogan, ex-President of the Central Railway Club, said that he had considered it an honor and a privilege to be afforded an opportunity to mingle with the Railroad Club Secretaries around the social board. To do so he considered a mark of respect which he felt he owed the Society of Railway Club Secretaries. A Railroad Club Secretary, who is mindful of his duty, faithful to the same and in all respects fully com-

petent, was invaluable to the organization, because he is the man who keeps it going financially, and who helps to increase its membership as well as the maintenance of a live interest in its affairs. The time has come, Mr. Hogan said, when railroad officials must induce their men to become members of railroad clubs, because the work of these organizations is such that it is educative and men are fitted to educate others. The man who attends railroad club meetings is a stronger and better man, and better qualified to deal with the various questions that come up in his daily experience.

The labor question was just now a great problem for railroad men, and they have come to know that in apprentice schools and apprentice systems is afforded one of the means for its practical solution. Mr. Hogan believed that what had already been accomplished indicated that all railroads would have to adopt it in order to educate men above their present level. With the work of railway clubs encouraged, and apprentice schools established, much more would be accomplished in educating men to a better appreciation of what they owe to the companies that employ them.

Superintendent Phillips, of the Lackawanna Road, said he had been impressed by the remarks of the preceding speakers, especially those of Mr. Besler with respect to the inefficiency of labor of today. The increase of wages has not brought about an increase in efficiency, but, on the other hand, there seemed to be a deterioration in the efficiency of labor, a lack of interest and pride in the work, an inclination to follow the dictation of labor leaders and rely on the various unions in holding their jobs for them, and this disposition and the service rendered was having a deteriorating effect in the efficiency of the service in nearly all branches of railroad operation.

He was disposed to regard as sound the opinion of an old-time official, who said that "in the growth and development of the labor organizations railroads had sown seed of which they were now reaping the harvest," and that the railroad official of today has great responsibilities resting upon him in dealing with the problem of labor and the great and growing business of the country; the development had been greater than could have, possibly, been anticipated, and in coping with these propositions

they were doing so without any precedents—as it were, blazing the way through virgin forests, and to solve the problems of the present, in order to properly meet conditions connected with the great and growing traffic of American railroads. Mr. Phillips believed it was incumbent upon railroad officials in the education and development of themselves, to have some regard for the men under them and to do quite as much for the improvement of those men.

Mr. McIntosh said that Secretaries were the motive power—the energy of the railroad clubs with which they were connected—and their work and influence is largely responsible for what the clubs accomplish. He was proud to commend their labors and esteemed it a pleasure to be present with them during a social hour like the present.

He also believed that such remarks as had been called out during the time that the Secretaries and their guests had been together might have an important outcome. The suggestions which had been offered must appear to all and should induce men to participate in railroad club work. These clubs did much to prepare the way for the later accomplishments of the Master Mechanics and Master Car Builders' conventions, with correspondingly valuable results.

Mr. McIntosh suggested that, possibly still much more good might be accomplished by and for the railroad clubs if auxiliary organizations were formed to meet at terminals and other convenient points as a means to prepare men for and interest them in railroad clubs and the work for which they are organized, and so, ultimately, at the proper time, to bring them into the clubs. Having thus inspired their interest therein, they would be qualified to take an active part in the general organization.

Mr. McIntosh recalled that, originally, it was sought to confine membership in clubs to strictly technical men, and they made poor headway. It was found advisable to open the doors to men connected with other branches of railroads until at the present time, membership in those successful organizations comprises a general representation of all departments.

Mr. Walsh said he could not add much to what had already been stated, but he felt compelled to say that the Secretaries are

the very heart of the organizations they represent. He knew this to be true of the Secretary of his club, to whose untiring efforts as one of the best and most persistent, energetic Secretaries he had ever known was to be attributed the progress made by the Richmond Railroad Club.

Mr. Cleaver, as the final speaker of the evening, made an earnest and emphatic argument in favor of the supply men and liberally supporting railroad clubs by advertising in their published Proceedings. These clubs, he said, are a good thing, but it means something to keep them going, and that something is money. While membership dues are a source of revenue, they are not sufficient for all the purposes of the organization, and so they are very largely dependent upon the profits derived from advertising. While it was true that supply men and the houses they represent are generally inclined toward railroad clubs and disposed to give the substantial evidence of their application, as manifested in their advertising contracts, it could not be truly said that they did not receive an adequate *quid pro quo* for their investment, because the published Proceedings of a club are an indisputably valuable advertising medium for the men engaged in selling railroad supplies. They are preserved after being carefully read, and not cast aside as of no further use. Therefore, Mr. Cleaver said, advertising in club Proceedings is not a charity, for the advertiser receives full value in that he keeps himself constantly and conspicuously before the men he wishes to reach with his business and who, possibly, he could not reach in any other way.

The amusement of the guests was added to by the conjuring feats of Mr. Adams, who showed surprising skill for an amateur, and that a supply man can be an expert in more than one line of effort.

At the suggestion of Mr. Besler, the guests joined hands and united in singing *Auld Lang Syne*, thus closing the Secretaries' Annual Meeting of 1907.

Respectfully submitted,

HARRY D. VOUGHT,
Secretary-Treasurer.

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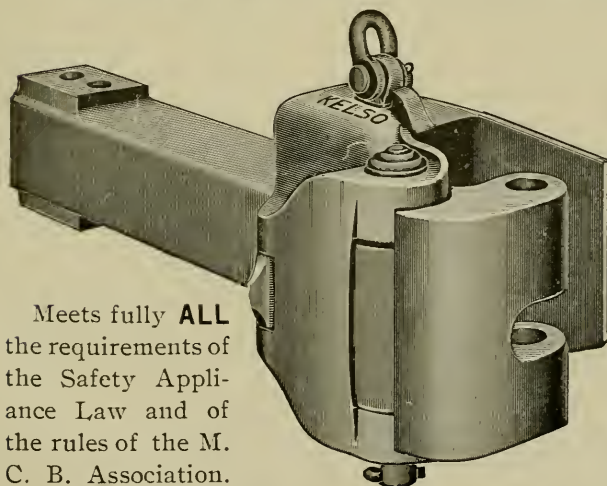
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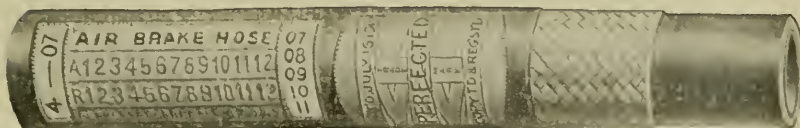
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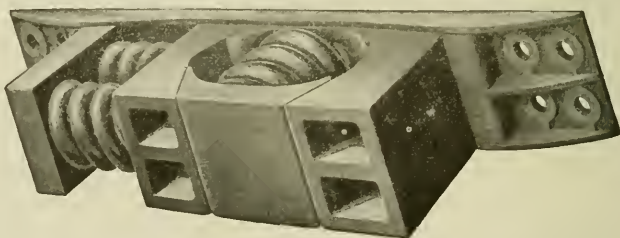
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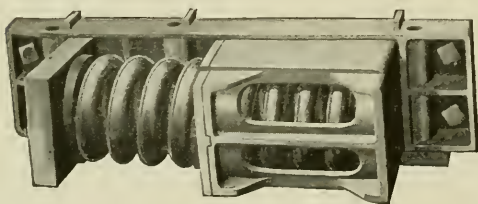
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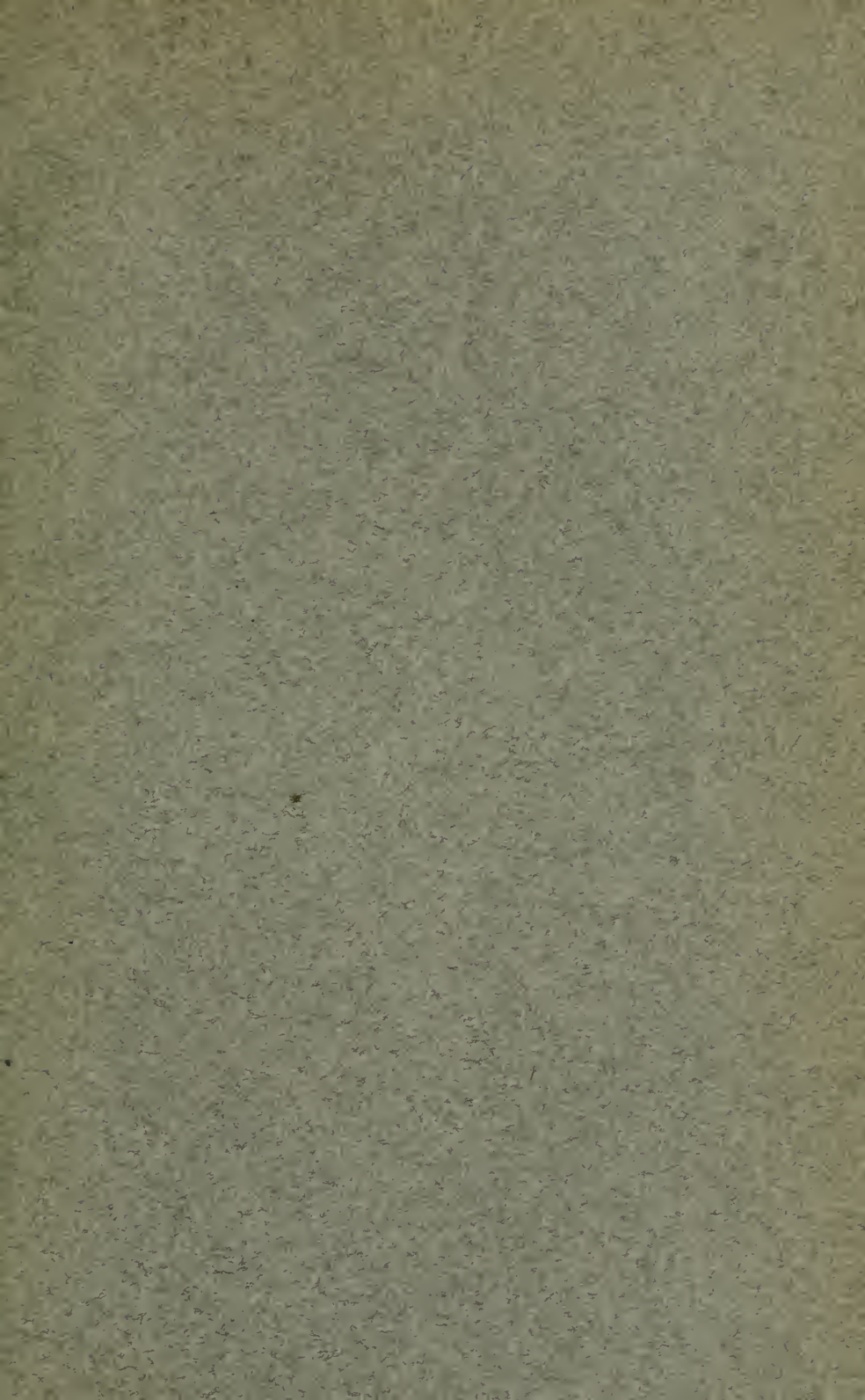
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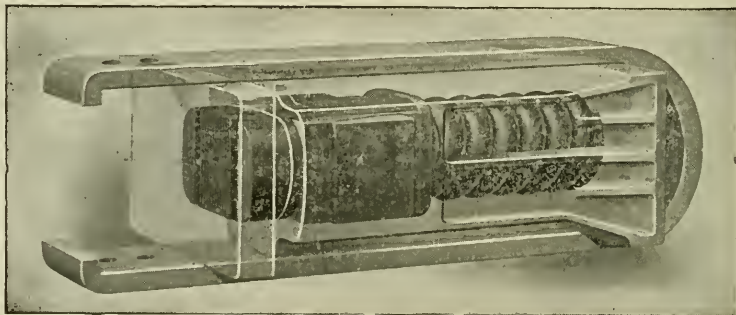
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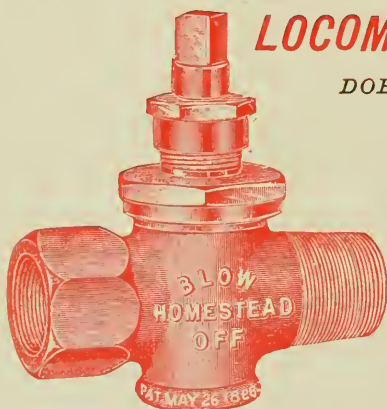
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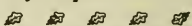
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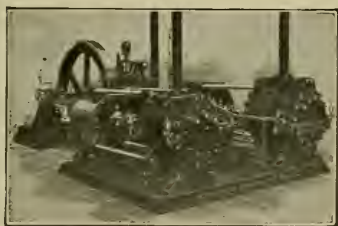
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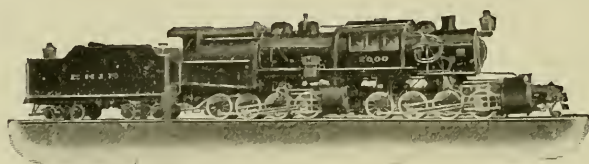
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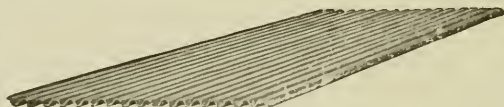
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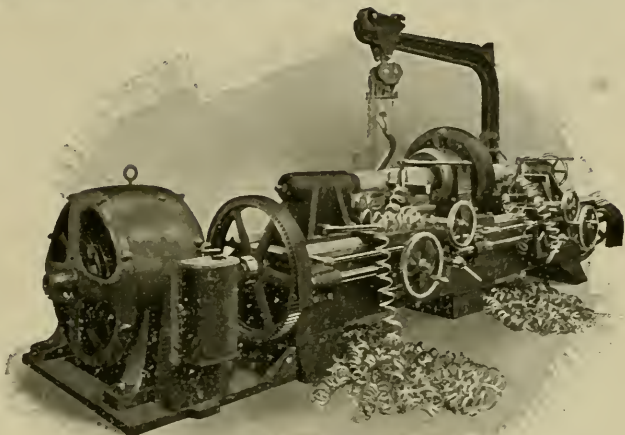
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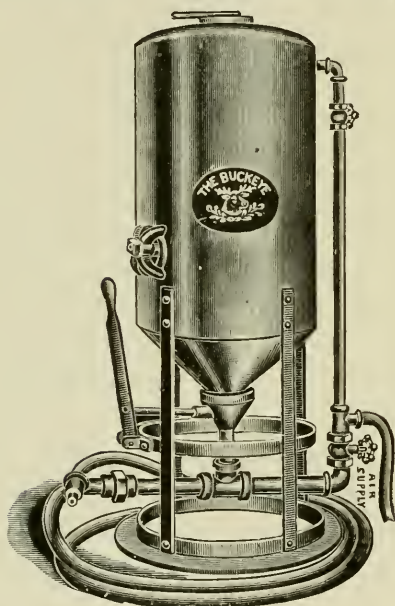


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VOL. VI.
No. 9.

Pittsburgh, Pa., Oct. 25, 1907.

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Published monthly, except June, July and August, by the Railway Club of Pittsburgh,
J. D. Conway, Secretary, General Offices P. & L. E. R. R., Pittsburgh, Pa.

Meetings held fourth Friday each month, except June, July and August.

**PROCEEDINGS OF MEETING,
OCTOBER 25th, 1907.**

The meeting was called to order at the Monongahela House, Pittsburgh, Pa., at 8:40 o'clock, P. M., by President Stark, the annual meeting this year taking the form of a banquet, at which

two hundred members and friends and ladies were present. At the conclusion of the dinner, the President called the meeting to order.

Proposals for membership as follows:

- F. L. Arensburg, Rep., Vulcan Crucible Steel Co., Oakmont, Pa.
A. E. Barney, Mgr., Pittsburgh Rubber Co., 913 Liberty Ave., Pittsburgh, Pa.
L. H. Constans, Traf. Mgr., Pittsburgh Steel Co., Frick Bldg., Pittsburgh, Pa.
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Wm. Hamilton, Pres., Erie Car Works, Erie, Pa.
R. P. Keenoy, Sup't. Trans., American Steel & Wire Co., 15th St. and Penn Ave., Pittsburgh, Pa.
R. F. Kiefer, Draftsman, Jones & Laughlin, Box 697, Beaver, Pa.
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H. G. Williams, Yard Master, P. & L. E. and M. C. R. R. Co.'s, 4726 Blair St., Pittsburgh, Pa.

Altoona, Pa., October 4th, 1907.

My dear Conway:—

I learned that I was nominated as one of the candidates for President of the Railway Club of Pittsburgh, and deeply regret that I am compelled to request you to withdraw my name from the nominations, as in the event of possible election, I would be unable to serve.

I am now on a number of committees of the Railway Club of Pittsburgh, Railroad, and M. C. B., and my duties are such, at the present time, as to prohibit me from accepting the very high honor conferred by placing my name in the eligible list for President of the Railway Club of Pittsburgh.

I desire to express my appreciation and thanks to the members for considering me, and pray you to take my name from the letter ballot sheets.

Very truly yours,

R. L. KLEINE.

Mr. J. D. Conway,

Secretary, Railway Club of Pittsburgh,
Pittsburgh, Pa.

SECRETARY'S REPORT.

To the Officers and Members of the Railway Club of Pittsburgh.

Gentlemen: Your Secretary is pleased to present briefly the events closing the sixth anniversary of our organization. We can certainly point with pride to the progress and achievement accomplished during the year. The subjects presented and discussed have been even of a higher order and more instructive in the main than in previous years. This is not spoken in a manner to detract from the very excellent papers we have had in past years, but might be explained by a growing interest in the organization.

Our growth in members, it will be seen, is creeping upward. While we have sustained a loss of quite a large number, suspended for non-payment of dues, resigned, etc., this is considerably overcome by new members.

This report would be incomplete if I failed to speak a word in praise of the one strong factor and a very important essential

to the welfare and success of the Club, i. e., "the advertiser." From this source we derive very largely the financial aid to meet the expenses in presenting the Proceedings to the members in an attractive form, "and, indeed, we owe them much."

Death removed from our midst during the year the following members:

AUGUSTUS DOWDELL,

D. L. MACOMBER,

W. J. MARTIN.

I will take this occasion to thank my friends for their kindly aid and assistance which lessens very largely the work that necessarily devolves upon the Secretary.

The following is a summary of the membership, financial condition, etc., for the year up to and including this meeting:

MEMBERSHIP.

Reported last year.....	739	
Received into membership during year.....	130	
Re-instated.....	1	
	<hr/>	870
Suspended, non-payment of dues.....	49	
Resigned.....	28	
Loss of address.....	13	
Removed by death.....	3	
	<hr/>	93
Present membership.....		<hr/> 777

FINANCIAL.

RECEIPTS—

In hands of Treasurer last year.....	\$1,357.91	
From advertisers.....	1,563.89	
From dues.....	1,802.00	
From sale of Proceedings.....	45.50	
	<hr/>	\$4,769.30

DISBURSEMENTS—

Printing Proceedings, advance sheets, notices, etc.....	\$1,924.27	
Hotel, luncheon, etc.....	506.55	
Postage for Journals, etc.....	339.34	
Secretary's trip to Atlantic City and New York.....	65.00	
Cigars for meetings.....	112.00	
Entertainment.....	209.00	
Stationery and supplies.....	44.00	
Messenger service.....	28.80	
Secretaries' Association Dues.....	10.00	
Reporting Proceedings.....	120.00	
Salary, Secretary, year 1905-1906.....	500.00	
Miscellaneous.....	11.53	
		<u>\$3,870.49</u>
Balance in hands of Treasurer.....	\$898.81	
	J. D. CONWAY,	Secretary.

Approved:

L. H. TURNER,
F. R. McFEATHERS,
R. H. BLACKALL,
Executive Committee.

TREASURER'S REPORT.

Pittsburgh, Pa., October 25th, 1907.

RECEIPTS—

Balance on hand from last year.....	\$1,357.91	
Received from Secretary during year.....	3,411.39	
		<u>\$4,769.30</u>

EXPENDITURES—

Paid out on Secretary's checks.....	3,870.49	
		<u>\$ 898.81</u>

Balance on hand.....

Respectfully submitted,

J. D. McILWAIN,
Treasurer.

Approved:

L. H. TURNER,
F. R. McFEATHERS,
R. H. BLACKALL,
Executive Committee.

PRESIDENT: Ladies and Gentlemen:—It gives me great pleasure to greet you and to welcome you on an occasion of this sort, our first Railway Club banquet. We are pleased to have with us the ladies whose presence will add dignity to the social event. We are glad to have with us the young, the middle aged, and those well along in years, and we are especially proud of our older friends.

The Committee is to be congratulated for having secured such eminent speakers for this occasion. We regret very much that one or two who had expected to grace the occasion have been forced to be absent. It gives me pleasure to introduce to you the toastmaster of the evening, our esteemed member and friend, Colonel J. M. Schoonmaker.

TOASTMASTER: Mr. President, Ladies and Gentlemen:—I am very glad to be able to say "Ladies and Gentlemen." It has been "Gentlemen" heretofore.

It is not my intention to preface my remarks tonight with the "unexpected honor and great privilege of presiding as toastmaster on this occasion," for I honestly think that if there is one unnecessary incumbrance on an occasion of this kind it is the professional toastmaster. I can't for the life of me see why I should be slated to take the place of this good President who has done so much to build up this institution, a child of but a few years but grown up almost into the thousands in number, whose influence is far reaching, the purpose of which is to put within the range of all the members a higher sphere, and better educational lines of instruction than are always possible under other circumstances; papers read here that are intellectual treats—the whole purpose and character of this is edifying and instructive. And now that the ladies of our homes have graced us with their presence, I see the future of it as an organization is safe.

Unfortunately two of our speakers, who I know would have greatly interested and entertained you, as your President has stated, have been prevented by reasons beyond their control from being present. We have substituted for them two others who will address you, for whom, under the circumstances, I reasonably ask your indulgence. Neither of them primed before

coming here, and did not expect to make any extemporaneous speeches, and their task will be onerous.

As for me, I am very much gratified, inasmuch as you are to be afflicted with a toastmaster tonight, that I take my place before you before many of the laws which go into effect during the present era and with the coming of the new one, for I am very sure that a number of the faces that I look into tonight are not likely to be here at the next annual dinner. And I should not be a bit surprised if on a visit to the penitentiary next fall I should have pointed out to me for instance Convict No. 745621 as a man who was at one time an eminent jurist in this city, a man whose versatility in his profession and in his various occupations as president of a railway or president of a great corporation and chairman of another, should be an inmate of that institution for selling to ex-Mayor Guthrie 10 cent gas for 30 cents. No. 932642 would be pointed out as an eminent manager of a great institution in Allegheny County, convicted and imprisoned for selling steel ties and representing them to be "neckties." And so on down the line all the way through. The traffic manager of another great concern imprisoned for selling ore dust as a remedy for diphtheria. All these things are possible. And what is more serious, it is altogether likely that I may be with them. I am going to try to keep out, but I would have good company, at that. Or that we should ask the keeper I was telling you about "Where are the Pennsylvania boys?" and have him tell there were so many of them that they had to have a penitentiary all by themselves.

At least, with this introduction, and an apology for Judge Reed's absence, I want to introduce a new comer in the railroad life of Pittsburgh who has attained his position in probably a shorter time than any other man who ever came into this community; in charge of a transportation property that threatened to annihilate all the other railroads that came into existence, in a mass of confusion and chaos, misunderstood and misrepresented, he came here and has sifted the chaff from the wheat, put his property on a remarkable footing, and made himself respected by all in this same profession, Mr. B. A. Worthington, of the Wabash.

MR. WORTHINGTON: Ladies and Gentlemen:—You might well know that I would feel embarrassed to come here tonight not expecting to say anything, and having to take the place of another speaker, especially after having been introduced in such a complimentary manner as our toastmaster has just treated me to. I have been wondering just what I was going to say. Railroad men as a rule are not orators, and their ability in their profession is found rather in what they are able to do than in what they are able to talk.

As I sat here tonight there were two or three incidents that made me feel a little more at home. When I heard our old national melody, "The Wearing of the Green," I felt that if I had a little saw dust on the floor I would feel perfectly at home—although I must admit that we probably would need a little froth on the water.

Speaking of froth on the water, I ran across a little poem today that I think applies very forcibly to Pittsburgh, and it makes me doubt the advisability of drinking too much water. The fact is, one of the gentlemen who sat on my left but afterwards moved over to the right, remarked that the only objection he had to it was that if he got enough of it he would get drowned in it. The poem I alluded to reads as follows:

We have boiled the hydrant water,
We have sterilized the milk,
We have pressed the prowling microbe
Through the finest kind of silk.
We have bought and we have borrowed
Every patent health device,
And at last the doctor tells us—
We have got to boil the ice.

Speaking about a patriotic sentiment that would be aroused by a national melody reminds me of a patriotic Scotch sentiment that I once heard. The Scotch colonel of one of the Scotch regiments suggested to his sergeant that he take a vote among the privates to ascertain if the majority would be in favor of abandoning the kilt skirts and bare knees in favor of trousers. When the vote was taken the sergeant reported to the colonel that all were in favor excepting two. The colonel was much

disappointed, as he was in hopes the vote would be the other way. And he suggested to the sergeant that the names of those two noble patriotic Scotchmen should be enrolled on the tablets of their memory for all time, and he asked their names. The sergeant answered: "Michael Doolan and Patrick Murphy."

Most of you who are here tonight are acquainted with the gentleman who is responsible for my getting up here tonight. He is known as the walking delegate of the greatest railway on earth, the Pittsburg & Lake Erie, Mr. Terry. When I say the greatest railroad on earth I do not mean that it is any wider than any other railroad, and it is not quite so long as some. In fact, when they put on their fast trains between here and Chicago they consulted the Westinghouse Air Brake people to see if they could not invent an air brake to keep them from running off the ends of the line when they got to running too fast. I think, now that I am identified with the Wheeling & Lake Erie, that we should lay some claim to Mr. Terry, as he started on that road.

And they tell a rather amusing story that I think will bear repetition. When he was associated with the Wheeling & Lake Erie Mr. Terry used to circulate around over the road looking for business. The Wheeling & Lake Erie in those days did not differ much from what it is today. We are not much of a passenger road. On a Fourth of July in one of the small towns out in Ohio they had a hot box on the engine and stopped to fix it up, and the townspeople were having their celebration down near the depot. Some one spied Mr. Terry, and like the rest of us, they all knew he was an orator, and so they got hold of him and brought him up there to read the Declaration of Independence. While he was reading it the trainmen had got through with the hot box, so they rang the bell and started up. And he saw it when he was in the middle of his reading, and as he could not afford to get left he jumped down and started out to catch the train. When he caught up with it he said: "Say, didn't you see what I was doing? I was reading the Declaration of Independence." The conductor turned around and said: "What the mischief do I care about the Declaration of Independence. I am a Democrat."

On my way into town I ran across two or three amusing little incidents. I got into the street car and there was a couple of ladies from the Emerald Isle sitting there, and one of them had a baby. She turned to the other lady and said, "Mrs. McGinnis, isn't he a beauty. He looks just like his mother." And the other lady replied, "Don't let that worry you, as long as he has good health."

A little later these two ladies got to talking again, and one said: "Did you hear that Mike Flannery had a steam hammer fall down on his chest and he is near dead?" "Well, well; I always knew that Mike had a weak chest."

I am forgetting the purpose of my toast. I notice the toastmaster said the speakers were to speak to the toasts. I find the toast I am to speak on is the "Relation of the Government to the Railroads." Everybody here knows that a railroad man don't know anything about that question. This toast was made for a lawyer. Lawyers can tell you all about it; we don't know anything about it. It would not be safe for us to know anything about it. I think the toast they ought to have had me down for, as long as they were going to have the ladies here and I am the handsomest man in the banquet hall, they ought to have given me the toast to the ladies. Because my wife, who is sitting over there, can tell you that I love all the ladies regardless of their age, color or sex.

The human intelligence cannot imagine what we owe to the ladies. They hold us up in the church affairs, they tell us all the little private affairs of the neighbors, they give us a piece of their mind sometimes and sometimes all of it.

But let the ladies slide, let us get down to the subject of this toast. When I got home today my wife just returned from Chicago and she told me of a family over in Chicago that were going to move to Pittsburg, and the little five-year-old girl of the family was kneeling down to say her prayers, and she said: "Good by, God, we are all going to Pittsburgh." I told that story to a Pittsburgher today and what do you think he said? He said, "That is an old story. But do you know what that child really said? You have got it punctuated wrong. What that child did say was: 'Good. By God! we are all going to Pittsburgh.'"

This summer my wife went up in the mountains near Cresson and did time in a little sort of a farmhouse there. They wanted to get a quiet place and a place, of course, that was cheap—we are all looking for a cheap place. She found a place there, but the room was rather too near the pig sty. She did not like that very much, especially when the wind was blowing toward the room. And the girl that waited on her at table was inclined to be rather fresh and did a great deal of talking. I wrote up there last week—a little early, perhaps—and told them we thought of going up next summer, but wanted to have the pig sty changed to some other place and we thought the girl a little too fresh. My wife had a reply when I got home. The gentleman wrote that "Sarah has went, and there haint been no hogs on the place since you left."

Railway men have very funny experiences. I will conclude my oration with a little experience that occurred on the road. Of course, on the Wabash lines east of Toledo our rules of discipline are very strict. I suppose Mr. Schoyer will enlighten you on the subject of discipline, because the Pennsylvania is even stricter than we are. But we do not allow any smoking on duty, and we have printed our rules to make them more effective. It doesn't always work, however. When I was going along over in the yard I came to a caboose where there was a brakeman sitting on the steps smoking a cigar. He didn't see me coming. When I got up to him I said: "Don't you know it is against the rules of the Company to smoke on duty?" He said: "Yes, sir." And he just kept on smoking and blowing the smoke up in my face. I said: "Which do you prefer, your cigar or your job?" He looked at me and said: "Well, I don't know, Mr. Worthington; they are both pretty darned rotten."

TOASTMASTER: I am sure, gentlemen, that you will join with me in the opinion that we will go back from this helpful occasion edified, instructed and interested by Mr. Worthington's remarks on the relation between the government and the railroads. I understand the situation thoroughly now, and I hope you do, too. I hope, if you will pardon the suggestion, that his remarks be reduced to print and sent to the members of the Club who are not present tonight. Under the circumstances, I think he did remarkably well.

The train has been off the track, but the engine is out of the ditch and on the rails again, and we have before us a speaker who had the courage to come under these circumstances and not dodge it as the other two boys did. His subject is one that is vital in the management of railway affairs. It is one very hard to deal with, because in all stations of railroad life there must necessarily be the subordinate and the superior. A tactful superior, especially one who has gone up through the ranks, comprehends as he makes these regular steps from the lower to the higher just where he is going. I refer to this only as an introductory speech. I do not want Mr. Schoyer to understand that I propose to eat the ice off his cake by making his speech for him. He can do that very much better than myself.

I want to take this opportunity of expressing to him my personal gratification at having him accompanied by his charming mother. I think it is a very pretty compliment that she should have honored us with her presence on this occasion. There isn't any such endearing term the world over as mother. It appeals in every direction to all of us, whether our mothers are here or in heaven—because all mothers ought to go to heaven. I know my mother ought to go to heaven if ever any mother ought, because she had a tough lot of boys to handle.

The other day I was in the Waldorf and sat down to a manicure and after the little preliminary introduction that always has to take place between yourself and the manicure—you know how it is—for lack of something else to say I said: "I would like to have you give me a real good job. I am going to see my sweetheart. Yes, I have a sweetheart." "Well," she says, "I will just fix you up to the queen's taste. Do you live here?" "No; I live in Chicago." I wasn't going to give myself away. "How long have you known her?" I says: "Quite a long time; she has been a very dear friend to me a very long time. She is a dear friend of my wife." The manicure looked at me with some surprise and said: "You don't mean to say your sweetheart is a friend of your wife." I said: "Yes, and my wife is a great friend of hers. They are kind of struck on each other." And I led her along into a mass of confusion until, interjecting a little preliminary remark, she said, "Your mother?" Now, I want to introduce Mr. Schoyer, his mother's sweetheart.

MR. A. M. SCHOYER: I am very much obliged to the Colonel for that introduction, because the first knowledge I ever had of discipline came from the lady about whom he has been talking.

I do not think there is any subject before railroad men to-day quite so important as discipline. It is a subject that the railroad man of tomorrow may have more difficulty with than the railroad man of today, because of the fact that, from one reason or another, the tendency of the age is to render more and more difficult the application of individual discipline.

Every man here who is in the railroad business knows what discipline means. For the benefit of those who do not understand it from a railroad standpoint, I would say that to "discipline" means to "disciple" or to "teach." There are many people today who think that the old-time idea of disciplining a man for doing wrong is entirely mistaken and that, instead of disciplining a man in the railroad service who makes a mistake or disobeys a rule or runs past a red light, some more beneficent method of correcting his error might be tried. That view would be correct if the object of discipline were to punish. But the object of discipline is not to punish, but to teach.

You remember that when you were a child and your brother did something that was good and got some special reward, money or a present, or was taken to a show, or had something especially pleasant done for him, it was very delightful for him and it was quite nice for you as his brother, too; but that was never an incentive to you to go and do as he had done. But when your brother did wrong,—when he fell in the ditch with his new suit on, or told a story, or stole a piece of pie, or did any of the things boys do,—if he was whipped, put to bed, got no supper, or anything like that; you remembered it for a long, long time. And many a time afterwards, when you felt inclined to fall in the ditch, or tell a story, or steal some pie, you did not do it because you remembered how your brother had been treated. And when you were whipped yourself, it was a long, long while before you did that thing over again.

Now, that is the object of applying discipline in the railroad

world, and I suppose it is the same in any other world, though personally I am not well acquainted with any other.

It is not an easy thing to make a man obey rules. It is not easy in the army or in military life to make a man absolutely obey; yet it is essential to a well-trained army. And no one knows how many hours of hard work the inspectors of an army have to go through before they get the soldiers so that they will instantly and absolutely obey the command of the commanding officer.

I stood in the Tower of London last year and watched the soldiers drill; it was a magnificent sight. After they got through drilling the splendid soldiers, who moved like one man, and had dismissed them, they called another squad and stood them in front of the Tower; there were about forty in the squad. Some had buttons that were not polished, some had their caps on a little awry, some had their knapsacks on a little bit wrong. Every man stood perfectly straight and toed the line. Then the commanding officer and the inspector went up and down the line, and, if a man's knapsack was on crooked, they straightened it; if his collar was too high, they pulled it down; and the man had to stand like a statue while they did it. It was done to teach the awkward soldiers and the good ones, and at every window in the Tower you could see soldiers watching what was done to the awkward squad.

If the army, with its magnificent corps of officers and magnificent rule, finds difficulty in enforcing the strictest kind of discipline, how hard it is for railroad officers to do so, when we remember that in our world we not only have to have absolute obedience to the rules, but, also, absolute ability in the subordinate to act individually. Our men cannot act like automatons; they have to obey like an army and think like a general; and to require a combination of the thought of the general and the instant obedience of the private is the difficult problem before the railroad officer today, and the only way he can do so is by strict discipline, which in some way will fasten the impression on the mind of the other men when a mistake is made.

The effort of many of the organizations of our men today, in this country, is to have discipline waived, or to have some

milder form administered so that instead of saying that, when a man disobeys a red signal, he will be suspended—laid off without pay for a certain length of time, or discharged or reduced in rank, or have some other discipline administered to him, book notation will be made that he disobeyed the rules, the error thus being charged against his record. This is only an effort to have some milder system established so that the individual will not suffer for his acts.

As the laws are today, and, as Col. Schoonmaker says, they will be much more stringent in the future, it is difficult to see how we can be milder in discipline, and, at the same time, run the railroad with absolute safety. A man can make a mistake in almost every other line of business in the world, and it does not mean anything, because it can be corrected. But let an engineman on a passenger train or a freight train make the slightest mistake, and there are apt to be very serious results. And the serious engineman, and the serious conductor, and the serious switch-tender, understand this, and it is the effort of their lives not to make any mistake. Yes, and the thoughtful ones are thankful to the railroad officer who will not be too lenient in his application of discipline, but will be sufficiently severe so that all the more they will understand what it means to disobey one of these fundamental rules.

The officer who administers discipline is large-hearted and is a man, just like the man who stands before him. Most of the railroad men I have known have very large hearts. The officer would like to say to the man: "Don't you ever do that again," and show him the door. But he cannot do it, because this one is not the only man to be affected; a thousand other men are looking to see what is done, and if there is a let-up in the slightest degree in the application of discipline, as an earlier speaker said, the men become lax, and in a little while we would have more of those terrible accidents reported—those accidents about which the newspapers are talking so much.

I don't know what causes all of these accidents. I don't believe that there are nearly so many, in comparison with the number of people carried on the railroads, as there were formerly; but if there are more than there used to be, it is because

the railroad officers are not following up this matter of discipline as they did twenty years ago. Twenty years ago it was an individual matter. When John Smith broke the rule, he suffered for it, and all the other men on the road knew it. Today John Smith breaks a rule, and an accident results; by all the rules of railroading he should be disciplined. It is too bad that this discipline would punish his innocent wife and children, too, but it has to be. Anyway, John Smith should suffer. But instead of John Smith's being suspended for thirty or sixty days, a committee calls on the Superintendent and says: "We want to investigate this case with you. John Smith is not as guilty as you think he is." Then an investigation is held, and instead of an effort being made to find out the facts of the accident, who was responsible for it, it degenerates into a court trial, with advocates and lawyers and twisting of rules, and perhaps a whitewash; and the result of it all is, and must be, a breaking down of the discipline. This weakens the authority of the executive, it weakens the obedience of the men, and the result of it all is that rules are made light of; and the next time a similar rule is disobeyed there is considerable question as to whether discipline should be administered at all or not, and the tendency of the officer is to pass it by; for what's the use?

Gentlemen, the investigation of an accident is not a trial before court; it is a clinic. The railroad officer should not be trying to convict a man, but to find out who made the mistake, so that he may hold up the guilty one as an example, that other men may not make similar mistakes. The aim of every railroad officer today is to handle his railroad with safety, to carry passengers so they will not be hurt, to carry property so it will not be damaged, and to run trains on time; and the only way to do so is to have every man on the road absolutely and promptly carry out the rules of the railroad, these rules being based on the rules of safety; and, also, to be on the constant lookout for everything that might endanger the safety of those trains, with their precious loads.

We must be careful, gentlemen, to see that down to the minutest detail we correct the evils that are existing in railroad practice, or we will never be able to handle these railroads in safety. Every year there is a tremendous increase in the num-

ber of passengers carried, a tremendous increase in the number of passenger trains to be handled, a tremendous increase in the number of cars and tons of freight to be handled; and we must carry these passengers in safety and handle this property in safety, otherwise other men will take our places and do the work which we have failed to do.

I think the Interstate Commerce Commission are awakening to the fact that we must have better discipline, from the decisions which they have been making lately and their lessening interference with the application of discipline. And some of the States are awakening to the same fact. In many of these States laws are now being passed making the responsibility for accidents to rest not only on the railroad company, but on the railroad employe as well, and inflicting punishment on the company and the man. But we must help ourselves above all things, and we must not let anything—sympathy for the family, sympathy for the good employe, sympathy for the individual, or a desire to stand well with the organization—interfere with the application of discipline on our railroads, which we must conduct in such a manner that we can stand before God and man and say that we have carried out the trust that has been placed in our hands; because it is a sacred trust, and not a trust that we can pass off easily. It is not simply a matter of going to the paymaster and getting our salary, it is not simply a matter of sitting down and saying "What are you going to do about it?"—it is a matter of conscience. We must carry out our great commission in a way that will enable us to look our fellow-men in the eye and say: "We have done our best."

You must excuse this grave talk, after the pleasant one of Mr. Worthington. But it is high time that we awoke to the dangers that confront us in the railroad world. We must see that these boys growing up in the railroad world have learned their business, and one of the things they must learn is absolute obedience to the laws that make railroading safe.

So I will close these few remarks. I will not apologize for having made them. I will not apologize even to the ladies, because if they have not quite understood all I have said, they know what it is to have discipline in the homes, and that they

cannot pass by an offending child, no matter how much they love him, but they have to discipline him to prevent his doing wrong and to prevent the other children from doing likewise.

COLONEL SCHOONMAKER: Our engine is off the track again. Yet Providence has been very good to us, boys, for if there is a man prominent in the railroad profession today who knows more about the growth of the railroad it is the general representative of the car repair pool of the New York Central lines. Without further introduction or further delay, I have the pleasure of presenting Mr. Chamberlin.

MR. EUGENE CHAMBERLIN: Mr. Toastmaster, Mr. President, Ladies and Gentlemen of the Railway Club of Pittsburgh: This is a very distinguished honor, but yet a very embarrassing one. But a few moments before entering this room I was touched upon the shoulder by a member of the Committee who said: "You are expected to make some remarks, in the absence of a more able speaker."

I feel somewhat embarrassed that I am compelled to follow such able exponents of the faith as the representatives of the great Pennsylvania System and the Wabash. I have had no opportunity to prepare a seemingly impromptu speech. As evidence of this you will notice that the gentlemen speaking previously are dressed for the part while I am not.

It has been my privilege and honor for a number of years to be a member of the Railway Club of Pittsburgh. And I am frank when I say to you that I made personal application for membership because I had an honest, sincere desire to in some way connect myself with the great City of Pittsburgh and its interests, and it seemed to me the proper avenue through which I might attain this glory with the greatest economy to myself was through the Pittsburgh Railway Club. In this I have not been entirely disappointed. I have in a measure shone by reflected glory in reading the notable articles published from time to time in your magazine. I have committed certain acts of plagiarism by cutting and quoting from those articles without giving credit therefor, and I have paid my annual dues to this Club when properly urged by the Secretary. I have attempted upon several occasions to mingle with your citizens, with more

or less success; because, my friends, I had an honest idea that I would like to learn the method by which they attained such an Aladdin-like success in such enormous fortunes in Pittsburgh. My reasons were obvious. I have been somewhat handicapped in my search for knowledge. For instance, six months ago I would get into conversation with some gentleman in Pittsburgh who apparently was not overburdened with this world's goods, and six months later I would return and find that he had qualified for the millionaire class. Now, I never had the nerve to ask him how he accomplished this, nor did he ever volunteer any information on that point. But I assume that he accomplished it by honest and upright business methods, "because he is not yet in jail."

Pittsburgh is peculiar in some respects. With all your metaphysical penetration and perspicacity—and I use those terms knowingly—I have never yet been able to discover a citizen of the city of Pittsburg who was able to make plain to me the reason why you paint the stern wheels of your river steamers red. Now this may be a state secret, and I have never followed up or urged the question. Pittsburgh is peculiar somewhat in other respects. If the dead could rise and read upon their tombstones the epitaph inscribed by the hands of loving friends it would appear something in the nature of a surprise to the defunct. Pittsburgh has got that scheme beat a mile. In one of your magnificent parks in the city stands a magnificent monument inscribed with the virtues of a man who can come around on a Sunday afternoon and read what his neighbors think of him. And, my friends, you are right, absolutely right. How much better it is to get the confidence of your neighbor and negotiate a loan when you are alive rather than when you are dead?

Pittsburgh is not far removed from New York City. If I were not compelled to live in New York, Pittsburgh would be my choice for a home by all means. Why, gentlemen, for obvious reasons. Your Aladdin-like success and your accumulation of fortunes here is so rapid that your neighbors will not take them away from you. And what do you do? You hie yourselves to the city of New York where the vocation of separating a man from his coin is reduced to an exact science.

Now, I don't know what else I can say that would entertain you. I had made a few notes for a speech, but I guess I will not make the speech. Gentlemen, you are all right. And it does not require one occupying my humble position with a railroad to voice that sentiment. I stand before you with uncovered head and in an attitude of respect offer my tribute, inconsequential though it be, to that institution in Pittsburgh that has few equals and no superiors, because it has the approval of the fair sex, "the Railway Club of Pittsburgh."

COLONEL SCHOONMAKER: Gentlemen of the Railway Club, I am going to ask you all to arise. I want you all to join me in the next toast, one that is very dear, I know, to every one present. All of you have had mothers, some of you have had sisters, some of you have wives and all of you, if you are the kind of men that I think belong to the Railway Club, have had or have now sweethearts. Drink to our next toast, "The Ladies." And I want to give the ladies, to respond to that toast, the handsomest man in the room, Mr. L. C. Bihler.

MR. L. C. BIHLER: Mr. Toastmaster, Ladies and Gentlemen:—In view of that introduction I will have to stand facing the front in order that the audience may see whether the Colonel has stated that correctly or not. Something like ten days ago I picked up a newspaper and read a little article which said that a special committee appointed for looking at the matter very thoroughly begged leave to report that a man on a lark, time flies, dog in the manger, fly in the ointment, bee in the bonnet, flea in the ear, bull in the china shop, are all nature fakes. It never happened.

Talking about nature fakes, everybody likes to have his little joke, and I guess Colonel Schoonmaker had his when he called upon an old batchelor who don't know anything about it, to answer to a toast of "Our Ladies."

Now, I did not have quite as much time as Mr. Chamberlin to prepare this address. I was only told after Mr. Worthington sat down that I followed Mr. Chamberlin, so that all I am trying to say I have had to think up in the last five or ten minutes—although I did send a note across the table saying that I was utterly incompetent, but the Colonel would not listen to it.

I suppose I have the same privilege as the rest of the speakers in departing from the subjects which have been allotted to them. In other words, I suppose I may say as much about "Our Ladies" as Mr. Worthington said about the "Relation of the Government to the Railroads," or as Mr. Chamberlin said on the subject of "Railroad Troubles." The only man who stuck to his text was Mr. Schoyer, and there is a good reason for that. His mother is sitting right behind him and would enforce discipline on him if he didn't.

Now, talking about these nature fakes, Mr. Worthington was introduced as a man that talks on the "Relations of the Government to the Railroads." He is a professional story teller—only he forgets to tell any stories on himself. If I recall correctly, this happened on the Harriman lines in California when Mr. Worthington was with them. He was finally made superintendent of a grand division and was very proud when they gave him his first private car. The name of that car was Orilla, a Spanish name meaning "flowing waters" or "still waters" or something like that. One night Mr. Worthington pulled into the station at Los Angeles, and those wise men came and hammered and rapped on the wheels—I don't know what they do it for, but they came along and rapped on the wheels and inspected the car and threw a big flashlight up in Mr. Worthington's eyes who was inside looking out to see what all the noise was about. And he heard voices outside saying: "I wonder who the divvle's car this is?" "What is it?" "O-r-i-l-l-a." "Well, it's the old man's car. I wonder why the painter didn't put a G on it?"

Now Mr. Chamberlin, a few minutes ago, remarked that the gentlemen were all right. I will go one further and say, "Ladies, you are all right." Sitting around here and looking as handsome as peacocks, it reminds me of a little story I heard the other day. A certain farmer had a lot of hens out in the yard, a fine bunch, and his wife had gathered together the largest of the eggs and colored them red, green, blue, yellow, and set them out to dry and have them ready for the children for Easter. While the eggs were drying along came the old rooster and some hens, and they looked at those colored eggs a minute and flew back to the barn crying, "Kill the peacocks."

Mr. Chamberlin did say a little bit about his text, and so I will say this: "Our ladies, the light of our hearts, our homes and our lives. God bless them."

COLONEL SCHOONMAKER: As you know, the Railway Club has some formal work to do, and I will turn over the meeting for a few minutes to Mr. Stark.

PRESIDENT STARK: Ladies and Gentlemen:—I am sorry that you are the victims of circumstances. The delightful part of the evening is over, but my esteemed friend, Mr. Barnsley, took me by the collar and said: "Stark, you have got to make that address," and said that hereafter a qualification for the office of President of the Railway Club would be an ability to make an address. To make an impromptu speech is something that I never attempted, and I doubt whether I ought to detain you by reading some prepared remarks.

MR. BARNSELEY: I beg to say that the rules have been made and there is nothing to do but carry them out.

PRESIDENT STARK: The nations of the world are enjoying the favor of God, and with few exceptions peace and prosperity reign. Western civilization is rapidly making its way into new and undeveloped fields, introducing a more progressive and higher standard of living. Stimulated by new aspirations, the desire for the necessities and comforts of life has created a greater demand for the products of the earth, the handiwork of man, and the benefits of intellectual research.

The inhabitants of our own beloved United States should well be thankful, for we are a favored nation. Our resources are unlimited and our wants more than supplied; yea, we are blest with intellectual and material privileges almost without limit.

In answer to the question, how long will prosperity continue, the President of the National Manufacturers' Association is quoted as saying: "While the United States has only 5 per cent. of the world's population, it produces 20 per cent. of the world's wheat, 25 per cent. of its gold, 33 per cent. of its coal, 35 per cent. of its manufactures, 36 per cent. of its silver, 40 per cent of its iron, 42 per cent. of its steel, 52 per cent. of its

petroleum, 55 per cent of its copper, 70 per cent. of its cotton, and 80 per cent. of its corn."

It is this solid product which gives the United States its position and its prosperity.

Our population has increased ten millions since 1900.

Our agricultural growth has trebled during the last fifteen years.

The value of manufactured products has almost doubled during the last six years. In the same period there has been an increase of over 45 per cent. in tonnage of coal mined.

With every added production or volume there is carried with it increased responsibility on the public carrier. The railroads have just awakened, as it were, out of a sleep, and find that the present demands for passenger transportation, annihilating space with greater safety and comforts, and the movements of all sorts of commodities in aggregate volume of over 100 per cent. as compared with an increase of only 20 per cent. to 35 per cent. in facilities in the way of terminals, main tracks, cars, etc.

Tonnage moved in 1896, 773,868,716.

Tonnage moved in 1906, 1,610,099,829.

An increase of 108 per cent.

The railroads have increased their main track mileage 21 per cent., freight car carrying capacity 26 per cent., locomotive tractive power 160 per cent. during the last ten years. The added locomotive capacity is not all available for greater train tonnage by reason of the fact that the time limit for passenger train schedules has been materially reduced; then, too, the delays to freight trains on account of lack of sidings, congested terminals, etc., have retarded the prompt movement of tonnage.

Our more direct interest, of course, lies in Western Pennsylvania, where nature has provided hidden treasures. These material resources at the hands of the pioneer, and up to the present date, have attracted the attention of the world, has made Pittsburgh famous as a manufacturing center.

Pittsburgh, "an inferno of overwhelming grandeur," is mild

in comparison with Parton's night vision in Pittsburgh, "Hell with the lid off."

The river valleys throughout Western Pennsylvania were first recognized on account of the abundance and rare quality of fuel in the way of coal, oil and gas. Thus capital was invited and invested notably for the production of iron and steel.

In 1905 the Pittsburgh district produced more iron and steel than the combined output of any single nation except the United States and Germany. She is fourth in the production of petroleum and fifth in the output of pig iron as compared with any individual country.

Pittsburgh district produces nearly one-half of the total glass and coke production of the United States and more than one-half of the tonnage of structural shapes.

During 1906 the freight traffic, inbound and outbound was 113,000,000 tons by rail and 9,000,000 tons by water.

"Coal is King, and iron ore Queen of the Empire of Pittsburgh."

The total tonnage of bituminous coal in the Pittsburgh district for the year 1906 was 48,948,906 tons.

The Pittsburgh Coal Company and its subsidiary companies produced out of the Pittsburgh district 23,480,541 tons, or approximately 50 per cent.

The available coal in the Pittsburgh district is estimated to contain a sufficient quantity to last 1000 years.

Pittsburgh has a daily capacity of 125,000,000 common brick, exclusive of paving and fire brick. She produces aluminum to the value of \$2,300,000; cork, \$2,500,000, and canned goods to the extent of \$7,000,000 per annum.

Some writer has referred to Pittsburgh as a roaring valley of perpetual motion, clouds of smoke by day and pillars of fire by night. Pittsburgh is the home of steel car industry.

Pittsburgh furnishes more material for freight car construction than any other district in the world.

Out of a total of 1,979,667 cars now in service 350,000 are of all steel or metal underframes.

Pittsburgh produces more distilled inspiration to revive and stimulate some that are weary of the pace, by exceeding other cities in the production of rye whiskey. She has the greatest food product establishment in the world. If perchance we over-indulge, we have a beverage for the stomach's sake, "Hostetter's Bitters."

Combine the tonnage of New York, London, Liverpool, Hamburg and Antwerp, the world's greatest ports, and the tonnage will not equal that of the Pittsburgh district. To put it another way, the tonnage of Pittsburgh is twice that of London, four times greater than Paris and more than New York, Chicago, Philadelphia, Boston and Baltimore combined.

Pittsburghers will build the great Lake Erie and Ohio ship canal, assist in improving the water ways to Cairo and thus maintain her supremacy.

Greater Pittsburgh, with its magnificent homes, churches, schools, parks, libraries, hospitals, lofty buildings, strong banking institutions, diversified industries, are admired the world over. Its people are the most energetic, charitable, law abiding and most eminently successful.

Through the contributions of Mr. Geo. Westinghouse the present attainments of the transportation power of the world have been made possible. Such men as Andrew Carnegie, Henry Phipps, B. F. Jones and others who have built up the steel industries making it possible to develop this and other countries are well worthy of praise and commendation.

The physical conditions confronting the railroads entering Pittsburgh make expansion a most difficult proposition. It will require the exercise of more than normal faith to remove the rock hills or contract the waterways so as to add even one more main track. The railroads entering Pittsburgh have measured up to the emergency quite as well as railroads in any other locality, and yet it will require the expenditure of millions of dollars more, under the supervision of Pittsburgh's expert engineers.

The Railroad Club of Pittsburgh will serve to assist in working out the difficult problems of operation and maintenance.

The railroad clubs are a very useful adjunct to the parent

organizations, the American Railway Master Mechanics' and Master Car Builders' Associations.

The work of the various clubs, through their standing and special committees, composed of members selected on account of their fitness, both by education and experience, bring together in conference men having to do with the problems of the day. Recommendations of the various committees are presented before the Club for consideration. I will here make a special reference to the committee on revision of the M. C. B. rules. This Committee is composed of a representative from every railroad entering the Pittsburgh district. This committee carries on its preliminary work by correspondence and finally meets for an all day session, deliberating on the subject from its various aspects. Their deductions are submitted to the Club, and, as a rule, are adopted without any changes or additions. The recommendations as adopted by the Club are submitted to the Arbitration Committee of the Master Car Builders' Association, and for the last three or four years the Arbitration Committee have approved more recommendations emanating from the Railway Club of Pittsburgh than all the other railroad clubs combined.

This certainly speaks well for the personnel of our standing committee, and especially of Mr. R. L. Kleine, its Chairman.

In addition to the work of the various committees we have papers, or lectures, delivered on special subjects pertaining to railroad construction, maintenance and operation. These subjects are presented by experts in their particular line.

The discussions are notable for the freedom on the part of members representing all interests regardless of position.

The proceedings are chronicled by one of the most efficient stenographers in the City of Pittsburgh and published monthly for the benefit of its members, and will prove of value for future reference. We enjoy the distinction of being the most unique club in that we have as active members persons representing the manufacturer, the selling agent and the transportation companies.

The producers and manufacturers join with the railroad representatives in an honest effort to expedite the movement of freight and mutually work together for one common end.

We may be placed third in point of membership, but first in hospitality. Our members of all ranks, together with friends and guests, lay aside all lines of caste and mingle together in a most delightful social manner.

The initial call signed by J. H. McConnell, then manager of the American Locomotive Works; D. F. Crawford, Superintendent of Motive Power of the Pennsylvania Company; L. H. Turner, Superintendent of Motive Power of the P. & L. E. R. R., and J. D. McIllwain, of the McIllwain Company, was made October 2, 1901.

The first meeting of representative railroad men was held in the parlors of Hotel Lincoln on October 18, 1901, when an organization was effected.

Mr. J. H. McConnell was elected the first President, a very fitting tribute to one having so successfully climbed the ladder of success to a remarkable degree.

Mr. McConnell was one of the pioneer mechanical men that inaugurated a system of statistics covering the earning power of locomotives and the cost of repairs, analyzing the relative performance of various classes and types of locomotives. The results of his efforts were recognized by the railroad world and his works are a matter of record.

Mr. J. D. McIllwain, a veteran railroad man (though still young) and graduated with a degree of Commercial Engineer, was elected Treasurer. He being so popular that he has been re-elected continuously, and as a rule without an opposing candidate.

Mr. J. D. Conway, our genial Secretary, has served the Club since its organization, and has proved himself a very ardent worker and capable Secretary.

Mr. L. H. Turner, our most popular club member, was the second President. He injected into the organization the earnest, practical enthusiasm that had marked his long and successful career in charge of the mechanical department of a railroad whose earning power, per mile, places it at the head of the list.

My most worthy successor, Mr. H. W. Watts, will make an admirable presiding officer. A very conscientious, practical man, I bespeak for him your most loyal support.

I would be manifestly ungrateful if I should forget to make mention of the loyal support of the officers and members of our Club. Together we have progressed each year, over which we are indeed proud.

MR. CHAMBERLIN: Mr. Toastmaster: With your permission, Ladies and Gentlemen:—It may seem to you that I am doing a great deal of unnecessary talking tonight for one who apparently has made no preparation at all. But I am delegated to perform perhaps one of the most pleasant duties that it falls to the lot of man to perform. With the abnormal growth of institutions in the City of Pittsburgh, this Club has come to follow in the same train. From a membership not quite seven years ago of 49 charter members meeting at the Lincoln Hotel, it has grown to the enormous membership of upwards of 800. You would not expect other results than those I have stated when I say that it has grown under the auspices of such able and competent men as my friend, Mr. Turner, and the other Presidents who followed him, and last, but not least, the competent gentleman who has filled the office so successfully for the past two years. And what has added to the dignity of this organization has been before us in a marked degree tonight when that gentleman of standing and influence in the City of Pittsburgh, for whom we all have the highest regard, whose heart is overflowing with the milk of human kindness and whose hand is extended always to those in need, and whose popularity and success the environment of Pittsburgh can in no wise contain—I mean him who in such a masterful manner has performed the functions of the office of toastmaster tonight.

But my duty, my friends, is a privilege in presenting to you, Mr. Stark, on behalf of your fellow-members of the Club, this magnificent token that you see before you. And I ask you in their behalf, though the token is magnificent, not to value it entirely for its intrinsic worth, which is very great, but to appreciate the heartfelt friendship and the kindly expression of feeling of your fellow-members which go with this magnificent present. And when you look at it at your home, may you feel that you constantly live in an atmosphere where envy is not thought of and malice is unknown, and where you feel that the happiest life is just your own.

(Mr. Stark was here presented with a magnificent chest of silver.)

MR. STARK: Mr. Chairman and Fellow-Members:—Indeed I hardly know how to behave under such embarrassing circumstances. I feel that I am somewhat like the young preacher who was preaching his first sermon, and he took for his text that passage of Scripture referring to Zaccheus. After his preliminary remarks he continued: "Zaccheus was a man of small stature, and so am I. Zaccheus wanted to see his Master, and so do I. Zaccheus was up a tree—and so am I."

I can hardly understand why I am entitled to such recognition. I could understand when my friend, Mr. Turner, completed his term of office, why it was befitting to remember him in such a manner. I was elected President of the Club as a substitute, and I presume the members of the Club want to reward me for that. The moral is for every ambitious man to do what is presented.

I became a member of this Club a comparative stranger in the railroad world in Pittsburgh. I was received cordially. Mr. Turner especially, and other members of the Club, encouraged me to do some little things. A year later they saw fit to renominate me. Why, some said we ought to have a man representing a large road, a man of position; but others said Stark would attend to business. That was a compliment which I thoroughly appreciate. And I want to express my great appreciation of the loyal support that I have had from all the members of the Club. And this token is beyond what I could expect. May this silver remind us that there is a silver lining to every cloud, and may our lives be prosperous and happy. And may this form a bond or a band that will encircle all of us and enable us the better to appreciate the intrinsic value of true friendship. Surely I feel that I am not entitled to such recognition, but I thank you all the more. I wish I could say something that would be befitting to this occasion, but words fail me and all I can say is, "I thank you."

I would now ask the Chairman of the Nominating Committee to announce the successful candidates for the various offices for the ensuing year.

MR. D. M. HOWE: Mr. President, we have completed the counting of the vote, and find that the following gentlemen have been elected officers for the ensuing year:

President,	{ H. W. Watts.
First Vice President,	{ D. J. Redding.
Second Vice President,	{ F. R. McFeatters.
Members of Executive Committee,	{ L. H. Turner, F. H. Stark, Geo. T. Barnsley.
Finance Committee,	{ D. C. Noble, H. V. Porter, Charles Lindstrom.
Membership Committee,	{ D. M. Howe, A. M. Schoyer, E. W. Summers, G. P. Sweeley, A. Stucki.
Secretary,	{ J. D. Conway.
Treasurer,	{ J. D. McIlwain.

PRESIDENT STARK: Mr. Watts, I think it would be very appropriate at this time for you to make acknowledgement of your grave responsibility.

MR. H. W. WATTS: Members of the Railway Club:—I want to express my appreciation of the honor you have conferred upon me. Unlike our President (?) I feel that it is the proper thing to preface these brief remarks that I will have to make, because it is a privilege to be a member of this Club, and it is certainly an honor to be called upon to preside over its meetings. As I have read the reports of the various railway clubs and their subjects of discussion, in the railway periodicals, I have felt that in variety of subjects treated, their helpfulness, their practical nature, and the exhaustive and able manner in which they have been treated, that the Railway Club of Pitts-

burgh is second to none. A club like this, in the nature of things, must have diverse subjects. The membership must cover a wide scope, because railway equipment draws upon every one of the great industries. And it is therefore a wise provision of our Constitution that includes in our membership not only men connected with the railroads, but also those connected with the affiliated industries. But this carries with it certain difficulties. One is that it is impossible to have subjects which will always interest all the members, and the temptation comes to us sometimes to remain away when the subject which was up for discussion was not one in which we were particularly interested. And I will confess right at the outset that I have been a grievous sinner myself in this respect. But I am unfortunate in living in the suburbs, on a railroad that I will not mention, because some of my friends here belong to that railroad. But we have a trolley line now and I expect to get here a little more regularly. But I think this arises from a rather narrow conception of the duties and privileges of membership in this Club. In the first place we have, as the men who are contributing to the success of the Club, men who make things. The man who makes a single practical suggestion, who suggests a single improvement which will tend to make railroading safer and more economical, and the man who by his persuasiveness and his familiarity with his subject can invade the office of the railroad president or general manager, superintendent of motive power or purchasing agent, and overcome his inertia and unwillingness to try a new thing, is a man who ought to be here at every meeting, because he is the man who is contributing as much, I was going to say more, than any other toward the good work of the Club. In these strenuous times when we are reading the grave editorials, theorizing as to the best method of getting out of our financial troubles, and when all of us who are so thoroughly familiar with everything connected with finance have our own theory, our supply man, our man with the talent for selling, is not theorizing. He is redoubling his efforts; he is the personification of energy; he is traversing the country far and near; he is getting into the office of the railroad financier, he is extolling the merits of the "best ever," trying to induce him to part with his money and put it into circulation through the highly meritorious channel which he represents. This is a man

who is not theorizing; he is doing something—or somebody. They are friends whom we cannot get rid of, and we would not if we could. We meet them at every point. We are glad to meet them. I was in the office of a supply man just yesterday, and as I looked at him handling the details of this banquet, in connection with his coadjutors, and having charge of the tedious job of counting these ballots and arranging for this testimonial to our worthy President, I thought to myself, it would be a small thing for a man like that to handle a railroad.

Now not only the man who makes and the man who sells, but the man who comes to the meetings comes in as an influence upon the welfare of the Club. It is a gratifying thing when a man has spent a good deal of time and labor in preparing an exhaustive paper, to come and read it before a large and interested and appreciative audience, and it spurs and stimulates those who take part in the after discussion. And then there is the personal factor. It is easier to remember a thing when you have in your mind the face of the man who has been speaking about it. You say you can read all that when you get your Proceedings at home. What American wants to read yesterday's newspaper today? The discussion becomes stale, flat and unprofitable. There are certain beverages which have to be imbibed as soon as they are drawn or they become stale, flat and unprofitable, I am told. I refer, of course, to soda water and pop and coca-cola and the water with the froth on it that was referred to a while ago by Mr. Worthington, I suppose.

In conclusion, let me express my appreciation of the large audience that has been gathered here at the first banquet of our Club. I noticed on the invitation that it was alluded to in one place as a banquet, in another place as a dinner, and I think now you will all agree with the sentiment expressed by the Scotchman who attended a funeral. A good meal was provided for the mourners, and he imbibed somewhat liberally of the liquid refreshment, so that the operations of his mind became confused and he arose and proposed the health of the bride and groom. The horrified friend who sat next to him pulled his coat tail and said: "Hoot, mon, it's no a wedding, it's a funeral." "Well, I dinna care whether it's a wedding or a funeral, it's a grand occasion, anyway."

MR. STARK: The hour is growing late, but I must introduce a gentleman who later on will become President, no doubt. We want to hear from the First Vice President, Mr. D. J. Redding.

MR. D. J. REDDING: Mr. Chairman, Ladies and Gentlemen:—I do not believe it is worth while for me to walk around back of the table, because I am like all the rest of the speakers, I came entirely unprepared for anything of this kind. However, I know that the duties of the Vice President are not very onerous, and he is not called upon very often to announce himself and become conspicuous in the management of the Club. The President, as a general thing, gets around to the meetings to see that things are run right. I promise the ladies, however, to see that their husbands get out in good time and get home. I think they will now appreciate the fact that there is no harm done here and that their husbands and sons and the gentlemen members of their families are in good company when they are at the Railway Club meetings, and are not due for a lecture on account of coming in a little late.

MR. STARK: I am sorry our former President, our first President, Mr. McConnell, is not able to be here; but it would be altogether out of place to adjourn without hearing from our former President, who perhaps has had more to do in the building up of this Club than any other one person, Mr. L. H. Turner.

MR. L. H. TURNER: It is another case of "wholly unprepared." I just want to say this, I want to compliment Mr. Stark upon the work he has done in the past few years. It is fully appreciated by the members. And I want to congratulate Mr. Watts on being elected President of this Club. I was President for two years, and it is the proudest thing that ever happened to me.

There is one thing I want to speak of. The Club has adopted the plan of putting the ex-Presidents on the Executive Committee. It only holds three and there are two of us on now, and when Mr. Watts gets in you have either got to make a larger bunch or find out some other use for ex-presidents.

While I am up I want to say something else. We are indebted to our Banquet Committee for the splendid dinner, the

exquisite music, and to our toastmaster and the gentlemen who have addressed us for the interesting talks, and I move that we express our appreciation by a hearty vote of thanks.

MR. STARK: I will invite the ladies to vote on this question. All in favor of the motion to extend a vote of thanks to our speakers and to our Banquet Committee, who have looked after every little detail in such a remarkable manner, I would ask to rise.

The vote is unanimous.

ON MOTION, Adjourned.

Railway Club of Pittsburgh Constitution.

ARTICLE I.

The name of this organization shall be "The Railway Club of Pittsburgh."

ARTICLE II.

OBJECTS.

The objects of this Club shall be mutual intercourse for the acquirement of knowledge, by reports and discussion, for the improvement of railway operation, construction, maintenance and equipment, and to bring into closer relationship men employed in railway work and kindred interests.

ARTICLE III.

MEMBERSHIP.

Section 1. The membership of this Club shall consist of persons interested in any department of railway service or kindred interests, or persons recommended by the Executive Committee upon the payment of the annual dues for the current year.

Sec. 2. Persons may become honorary members of this Club by a unanimous vote of all members present at any of its regular meetings, and shall be entitled to all the privileges of membership and not be subject to the payment of dues or assessments.

ARTICLE IV.

OFFICERS.

The officers of this Club shall consist of a President, First Vice President, Second Vice President, Secretary, Treasurer, Finance Committee consisting of three members, Membership Committee consisting of five members, and three Elective Executive Members who shall serve a term of one year from the date of their election unless a vacancy occurs, in which case a successor shall be elected to fill the unexpired term.

ARTICLE V.

DUTIES OF OFFICERS.

Sec. 1. The President will preside at all regular or special meetings of the Club and perform all duties pertaining to

a presiding officer; also serve as a member of the Executive Committee.

Sec. 2. The First Vice President, in the absence of the President, will perform all the duties of that officer; the Second Vice President, in the absence of the President and First Vice President, will perform the duties of the presiding officer. The First and Second Vice Presidents shall also serve as members of the Executive Committee.

Sec. 3. The Secretary will attend all meetings of the Club or Executive Committee, keep full minutes of their proceedings, preserve the records and documents of the Club, accept and turn over all moneys received to the Treasurer at least once a month, draw cheques for all bills presented when approved by a majority of the Executive Committee present at any meetings of the Club, or Executive Committee meeting. He shall have charge of the publication of the Club Proceedings and perform other routine work pertaining to the business affairs of the Club under the direction of the Executive Committee.

Sec. 4. The Treasurer shall receipt for all moneys received from the Secretary and deposit the same in the name of the Club within thirty days in a bank approved by the Executive Committee. All disbursements of the funds of the Club shall be by cheque signed by the Secretary and Treasurer.

Sec. 5. The Executive Committee will exercise a general supervision over the affairs of the Club and authorize all expenditures of its funds. The elective members of this Committee shall also perform the duties of an auditing committee to audit the accounts of the Club at the close of a term or at any time necessary to do so.

Sec. 6. The Finance Committee will have general supervision over the finances of the Club, and perform such duties as may be assigned them by the President or First and Second Vice Presidents.

Sec. 7. The Membership Committee will perform such duties as may be assigned them by the President or First and Second Vice Presidents, and such other duties as may be proper for such a committee.

ARTICLE VI.

ELECTION OF OFFICERS.

Sec. 1. The officers shall be elected at the regular annual meeting as follows, except as otherwise provided for:

Sec. 2. Written forms will be mailed to all the members of the Club, not less than twenty days previous to the annual meeting, by the three elective members of the Executive Committee. These forms shall provide a method, so that each member may express his choice for the several offices to be filled.

Sec. 3. The three elective members of the Executive Committee will present to the President the names of the members receiving the highest number of votes for each office, together with the number of votes received.

Sec. 4. The President will announce the result of the ballot and declare the election.

Sec. 5. Should two or more members receive the same number of votes, it shall be decided by a vote of the members present, by ballot.

ARTICLE VII.

AMENDMENTS.

Amendments may be made to this Constitution by written request of ten members, presented at a regular meeting and decided by a two-thirds vote of the members present at the next regular meeting.

By-Laws.

ARTICLE I.

MEETINGS.

Section 1. The regular meetings of the Club shall be held at Pittsburgh, Pa., on the fourth Friday of each month, except June, July and August, at 8:00 o'clock p. m.

Sec. 2. The annual meeting shall be held on the fourth Friday of October each year.

Sec. 3. The President may, at such times as he deems expedient, or upon request of a quorum, call special meetings.

ARTICLE II.

QUORUM.

At any regular or special meeting nine members shall constitute a quorum.

ARTICLE III.

DUES.

Sec. 1. The dues of members shall be \$2.00 per annum, \$1.00 of same to apply to subscription for Club Journal, payable in advance, on or before the fourth Friday of September each year.

Sec. 2. Each member will be assessed \$1.00 extra annually to provide light refreshments for each meeting.

Sec. 3. At the annual meeting members whose dues are unpaid shall be dropped from the roll after due notice mailed them at least thirty days previous.

Sec. 4. Members suspended for non-payment of dues shall not be reinstated until all arrearages have been paid.

ARTICLE IV.

ORDER OF BUSINESS.

- 1—Roll call.
- 2—Reading of the minutes.
- 3—Announcements of new members.
- 4—Reports of Committees.
- 5—Communications, notices, etc.
- 6—Unfinished business.
- 7—New business.

- 8—Recess.
- 9—Discussion of subjects presented at previous meeting.
- 10—Appointments of committees.
- 11—Election of officers.
- 12—Announcements.
- 13—Financial reports or statements.
- 14—Adjournment.

ARTICLE V.

SUBJECTS—PUBLICATIONS.

Sec. 1. The Executive Committee will provide the papers or matter for discussion at each regular meeting.

Sec. 2. The proceedings or such portion as the Executive Committee may approve shall be published (standard size, 6x9 inches), and mailed to the members of the Club or other similar clubs with which exchange is made.

ARTICLE VI.

The stenographic report of the meetings will be confined to resolutions, motions and discussions of paper unless otherwise directed by the presiding officer.

ARTICLE VII.

AMENDMENTS.

These By-Laws may be amended by written request of ten members, presented at a regular meeting, and a two-thirds vote of the members present at the next meeting.

MEMBERS

- Aikins, Jos. K.,
Chief Clerk to Supt.,
Pennsylvania R. R. Co.,
30th and Sarah sts., S. S.,
Pittsburgh, Pa.
- Alexander, J. R.,
Gen'l R. F. of E.,
Pennsylvania R. R. Co.,
Altoona, Pa.
- Alleman, C. W.,
Clerk. M. P. Dept.,
P. & L. E. R. R. Co.,
Pittsburgh, Pa.
- Allen, Harry L.,
Manager,
American Steel Foundries,
Alliance, Ohio.
- Allen, Harvey A.,
care Pressed Steel Car Co.,
McKees Rocks, Pa.
- Allen, Jas. P.,
Sales Agent,
Union Steel Castings Co.,
61st St. and A. V. Ry.,
Pittsburgh, Pa.
- Anderson, H. H.,
General Superintendent,
Schoen Steel Wheel Co.,
P. O. Box 1212,
Pittsburgh, Pa.
- Anderson, J. B.,
C. C. to S. M. P., P. R. R. Co.,
Union Station,
Pittsburgh, Pa.
- Anderson, H. T.,
Chief Draftsman,
Standard Steel Car Co.,
Frick Building,
Pittsburgh, Pa.
- Armstrong, R. S.,
Mgr., West Disinfecting Co.,
16th St. and Penn Ave.,
Pittsburgh, Pa.
- Arensburg, F. L.,
Rep., Vulcan Crucible
Steel Company,
Oakmont, Pa.
- Atterbury, W. W.,
General Manager,
Pennsylvania R. R. Co.,
Philadelphia, Pa.
- Atwood, J. A.,
Chief Engineer,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.
- Atwell, J. L.,
Mgr., Philip-Carey Mfg. Co.,
333 Second Ave.,
Pittsburgh, Pa.
- Ault, Chas. B.,
Sales Manager,
Lawrenceville Bronze Co.,
Pittsburgh, Pa.
- Ayers, H. B.,
General Superintendent,
American Locomotive Co.,
Imperial Bank Bldg.,
Montreal, Canada.
- Bagnell, R. A.,
Mgr. R. R. Dept.,
Invisible Roll Screen Co.,
No. 2 Wall St.,
New Brighton, N. Y.
- Bailey, Chas. D.,
Resident Manager,
Frank S. De Ronde Co.,
Ferguson Bldg.,
Pittsburgh, Pa.
- Baird, F. C.,
G. F. A., B. & L. E. R. R.,
Frick Building,
Pittsburgh, Pa.
- Baker, Edwin H.,
Rep., Galena Signal Oil Co.,
26 Broadway,
New York, N. Y.

- Baker, J. H.,
Clerk, M. P. Pept.,
Union Station,
Pittsburgh, Pa.
- Baker, Jas. H.,
Manager, Solid Steel
Tool & Forge Co.,
1240 Palo Alto St.,
Pittsburgh, Pa.
- Baldwin, Hasell W.,
V. P., T. H. Symington Co.,
Corning, N. Y.
- Baldwin, Stephen Y.,
Com. Frt. Agent,
D. & H. Co., Bessemer Bldg.,
Pittsburgh, Pa.
- Ball, Geo. L.,
Ball Chemical Co.,
907 West Diamond St.,
Allegheny, Pa.
- Barney, A. E.,
Mgr., Pittsburgh Rubber Co.,
913 Loberty Ave.,
Pittsburgh, Pa.
- Barney, H. E.,
Rep. Manning-Maxwell
& Moore,
Park Building,
Pittsburgh, Pa.
- Barnsley, Geo. T.,
County Road Engineer,
Pittsburgh, Pa.
- Barron, John,
V. P., Versailles Ry. Signal Co.,
Columbia Bank Bldg.,
Pittsburgh, Pa.
- Bartley, Milton,
President, American Nut &
Bolt Fastener Co.,
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- Barwis, J. Mc.,
Fore. Insp'r., P. R. R. Co.,
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Pittsburgh, Pa.
- Basford, G. M.,
care American Loco. Co.,
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- Bealor, B. G.,
Mgr., Winfield R. R. Co.,
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- Beatty, E. G.,
Rep., Galena Signal Oil Co.,
Franklin, Pa.
- Bell, T. H.,
M. M., N. Y. & C.
Gas Coal Co.,
Turtle Creek, Pa.
- Bell, W. K.,
Inspector, P. R. R. Co.,
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Pittsburgh, Pa.
- Bellows, A. B.,
Manager, Pittsburgh
Testing Laboratory,
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Pittsburgh, Pa.
- Belsterling, C. S.,
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American Bridge Co.,
Frick Building,
Pittsburgh, Pa.
- Bennett, H. R.,
Material Inspector,
P. R. R. Co.,
1013 Penn Ave.,
Pittsburgh, Pa.
- Bigelow, Harry T.,
Rep., Hale & Kilburn Mfg. Co.,
Fisher Building,
Chicago, Ill.
- Bizham, Chas. G.,
Pass. Cond'r.,
P. C. C. & St. L. Ry.,
Room 107 Union Station,
Pittsburgh, Pa.
- Bihler, L. C.,
Traffic Manager,
Carnegie Steel Co.,
Carnegie Bldg.,
Pittsburgh, Pa.
- Blackall, Robt. H.,
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Swissvale, Pa.

- Blair, A. C.,
Vice President,
Youngstown Car Mfg. Co.,
Frick Building,
Pittsburgh, Pa.
- Blattner, Jos.,
Cor. Allegheny Ave. and
Rebecca St.,
Allegheny, Pa.
- Blest, M. C.,
Chief Draftsman,
Pressed Steel Car Co.,
17 Woodlawn Ave.,
Bellevue, Pa.
- Bole, Robt. A.,
Manager, Manning, Maxwell
& Moore,
Park Building,
Pittsburgh, Pa.
- Bollinger, Conrad, Jr.,
Mgr. Ingersoll-Rand Co.,
Farmers Bank Bldg.,
Pittsburgh, Pa.
- Bonsall, J. S.,
Manager, American Engineer
and Railroad Journal,
1204 South 51st St.,
West Philadelphia, Pa.
- Booth, Arthur,
Asst. to Pur. Agent,
Philadelphia Co.,
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- Booth, J. K.,
Genl. Fore., B. & L. E. R. R.,
Greenville, Pa.
- Booth, Jas.,
Rep., Midvale Steel Co.,
Frick Building,
Pittsburgh, Pa.
- Bostwick, W. A.,
Metallurgical Engineer,
Carnegie Steel Co.,
Pittsburgh, Pa.
- Bowery, Fred,
Vice Pres., American Nut &
Bolt Fastener Co.,
306 Frick Building,
Pittsburgh, Pa.
- Boyd, Henry W.,
National Car Wheel Co.,
Sayre, Pa.
- Brady, Daniel M.,
President, Brady Brass Co.,
95 Liberty Street,
New York, N. Y.
- Brainerd, E. C.,
Sales Agent, Nicola Bros. Co.,
Farmers Bank Bldg.,
Pittsburgh, Pa.
- Brand, Thos.,
Train Master,
Montour R. R. Co.,
Coraopolis, Pa.
- Branson, Craig R.,
M. P. Inspector,
Pennsylvania Co.,
302 West Berry St.,
Fort Wayne, Ind.
- Brayton, Chas. A.,
President,
Standard Car Wheel Co.,
Cleveland, Ohio.
- Brentzel, J. E.,
Dispatcher,
Montour R. R. Co.,
Coraopolis, Pa.
- Brewster, Morris B.,
Rep., U. S. Metallic Packing
Co., 429 N 13th St.,
Philadelphia, Pa.
- Brittain, J. B.,
Asst. to Comp.,
Pennsylvania Lines,
Union Station,
Pittsburgh, Pa.
- Brooks, W. D.,
Local Manager, Pittsburgh
Plate Glass Co.,
Pittsburgh, Pa.
- Brown, A. D.,
C. C. to Genl. Manager,
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General Office,
Pittsburgh, Pa.
- Brown, E. W.,
Inspector, P. R. Co.,
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- Brown, H. B.,
Master Mechanic,
Erie R. R. Co.,
Cleveland, Ohio.
- Brown, F. Herbert,
President, Brown & Zortman
Machinery Co.,
cor. Water and Wood sts.,
Pittsburgh, Pa.
- Brown, Geo. P.,
Shop Clerk, Penn'a Co.,
1119 Franklin St.,
Allegheny, Pa.
- Brown, J. Alexander,
Manager, Pocket List of
R. R. Officials,
24 Park Place,
New York, N. Y.
- Brown, John T.,
Vice Pres. and Genl. Manager,
Damascus Bronze Co.,
Allegheny, Pa.
- Brown, John T., Jr.,
Supt. Duquesne Reduction Co.,
Farmers Bank Building,
Pittsburgh, Pa.
- Brown, Raymond B.,
Manager,
Duquesne Reduction Co.,
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- Brownscombe, G. J.,
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- Bruff, J. C.,
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Oil Well Supply Co.,
Pittsburgh, Pa.
- Buchanan, E. G.,
Rep., Carbon Steel Co.,
26 Cortlandt St.,
New York, N. Y.
- Buchanan, W. J.,
M. C. B.,
B. & L. E. R. R. Co.,
Greenville, Pa.
- Buckley, J. T.,
Rep., Jenkins Bros.,
P. O. Box 1493,
Pittsburgh, Pa.
- Bumbaugh, W. W.,
Pres., Monessen Foundry &
Machine Company,
Monessen, Pa.
- Burgher, R.,
Pres't., Kidd Bros. & Burgher
Steel Wire Co.,
Aliquippa, Pa.
- Burkhart, A. A.,
F. C. R., P. & L. E. R. R. Co.,
Glassport, Pa.
- Burns, Robert C.,
Fore. Car Inspectors,
P. R. R. Co.,
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- Burrell, J. E.,
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P. R. R. Co.,
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Pittsburgh, Pa.
- Burry, V. J.,
Draftsman, M. P. Dept.,
P. & L. E. R. R. Co.,
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- Caldwell, J. H.,
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- Callahan, D. A.,
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- Campbell, A.,
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- Campbell, G. E.,
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- Campbell, I. K.,
care County Commis-
sioners' Office,
Pittsburgh, Pa.
- Campbell, W. A.,
Sec. and Treas.,
Vulcan Crucible Steel Co.,
Aliquippa, Pa.
- Campbell, W. S.,
General Agent,
Wisconsin Central Ry.,
Park Building,
Pittsburgh, Pa.
- Cantrell, C. W.,
Sales Agent, Herman H.
Hettler Lumber Co.,
First Nat'l Bank Bldg.,
Pittsburgh, Pa.
- Cardwell, J. R.,
Pres., Cardwell Mfg. Co.,
Monadnock Block,
Chicago, Ill.
- Carney, J. J.,
Foreman Erecting Shop,
B. & O. R. R.,
Glenwood Shops,
Pittsburgh, Pa.
- Carson, G. E.,
Master Car Builder,
P. & L. E. R. R. Co.,
McKees Rocks, Pa.
- Cassidy, D. E.,
M. M., West Penn Div.,
P. R. R. Company,
Allegheny, Pa.
- Caton, W. J.,
Sales Agent,
American Lumber Co.,
Ninth Street,
Pittsburgh, Pa.
- Chamberlain, E.,
Chairman F. C. R. Pool,
N. Y. C. Lines,
Grand Central Station,
New York, N. Y.
- Chislett, Wm. B.,
Pass. Condr., P. R. R. Co.,
Union Station,
Pittsburgh, Pa.
- Chittenden, A. D.,
C. C. to Genl. Manager,
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Carnegie Bldg.,
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- Clancy, J. R.,
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- Coates, H. T., Jr.,
General Foreman,
Penna R. R. Co.,
Enola, Pa.
- Coen, P. A.,
Care Pittsburgh Coal Co.,
Coraopolis, Pa.
- Coey, David,
Rep., Schoen Steel Wheel Co.,
P. O. Box 1212,
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- Coffin, J. S.,
Manager,
Galena Signal Oil Co.,
Franklin, Pa.
- Coffin, W. E.,
Rep. National Malleable
Castings Co.,
Care "The Stratford,"
Cleveland, O.
- Cole, Jewett,
Inspector, P. R. R. Co.,
207 Union Station,
Pittsburgh, Pa.
- Collier, Paul M.,
C. C. to Asst. to V. P.,
Pressed Steel Car Co.,
McKees Rocks, Pa.
- Collin, J. E.,
Auditor,
Western Ally. R. R. Co.,
Diamond Bank Bldg.,
Pittsburgh, Pa.

- Collins, William,
Car Fore., Mon. Con. R. R. Co.,
Second Ave. near Bates St.,
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- Comstock, E. D.,
Genl. Pass. Agent,
B. & L. E. R. R. Co.,
Carnegie Bldg.,
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- Conneely, E. K.,
Chief Clerk to Pur. Agt.,
P. & L. E. R. R. Co.,
Gen'l Office,
Pittsburgh, Pa.
- Conner, J. E.,
Chief Clerk, Conway Yard,
Penn'a Lines West,
3rd Avenue,
Freedom, Pa.
- Connolly, W. E.,
Superintendent,
Pennsylvania Car Wheel Co.,
499 Preble Ave.,
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- Constans, L. H.,
Traffic Manager,
Pittsburgh Steel Co.,
Frick Building,
Pittsburgh, Pa.
- Conway, J. D.,
Chief Clerk to S. M. P.,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.
- Cooper, Geo. A.,
Sales Agent,
Frost Ry. Supply Co.,
Penobscot Bldg.,
Detroit, Mich.
- Copeland, M. V.,
Salesman, Standard
Supply & Equipment Co.,
811 Liberty St.,
Pittsburgh, Pa.
- Coudit, E. A., Jr.,
Rep., The Rail Joint Co.,
Lewis Block,
Pittsburgh, Pa.
- Coulter, A. F.,
G. C. F., Union R. R. Co.,
Port Perry, Pa.
- Courson, Chas. L.,
Asst. Fore. Car Inspectors,
P. R. R. Company,
Pitcairn, Pa.
- Coursin, J. F.,
General Foreman,
Pennsylvania R. R. Co.,
Pitcairn, Pa.
- Courtney, D. C.,
Supt. of Motive Power,
Coal & Coke Ry.,
Elkins, W. Va.
- Courtney, W. J.,
Manager Peerless Rubber
Manufacturing Company,
15 Wall St.,
New York, N. Y.
- Cover, N. C.,
Clerk to Gen. Foreman,
P. & L. E. R. R. Co.,
Haselton, O.
- Cox, P. L.,
Road Master,
Monon. Con. R. R.,
2nd Ave. near Bates St.,
Pittsburgh, Pa.
- Craig, E. A.,
South Eastern Manager,
Westinghouse Air Brake Co.,
Wilmerding, Pa.
- Crawford, D. F.,
Genl. Supt. Motive Power,
Pennsylvania Lines West,
Pittsburgh, Pa.
- Crawford, Harry M.,
Transitman,
Monon. R. R. Co.,
Brownsville, Pa.
- Crawford, P. S.,
Rep., U. S. Graphite Co.,
Colonial Hotel,
Pittsburgh, Pa.
- Cromwell, S. A.,
G. F. C. D.,
B. & O. R. R. Co.,
Painesville, O.

- Crouch, A. W.,
Engineering Dept., Dearborn
Drug & Chemical Co.,
House Building,
Pittsburgh, Pa.
- Crute, W. R.,
Asst. Engr. of Tests,
Norfolk & Western Ry. Co.,
Roanoke, Va.
- Culbertson, O. F.,
General Yard Master,
D. & H. Ry.,
Carhondale, Pa.
- Cullen, Jas. K.,
President,
Niles Tool Works,
Hamilton, Ohio.
- Cunningham, J. D.,
Sales Agent,
National Car Wheel Co.,
Allegheny, Pa.
- Cunningham, W. F.,
F. C. A., P. & L. E. R. R. Co.,
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Pittsburgh, Pa.
- Currie, J. C.,
Rep., Nathan Mfg. Co.,
85 Liberty St.,
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- Curtis, H. C.,
Clerk,
P., C., C. & St. L. R. R.,
Carnegie, Pa.
- Dambach, C. O.,
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W. & L. E. R. R. Co.,
Wabash Bldg.,
Pittsburgh, Pa.
- Dashiell, J. W.,
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- Daugherty, J. B.,
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- Davidson, W. H.,
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- Davis, M. J.,
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- Davis, Thos. R.,
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Flannery Bolt Co.,
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- Dawson, W. J., Jr.,
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- Day, Edward B.,
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- Decker, O. S.,
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Sligo Iron & Steel Co.,
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- DeGress, Francis B., M. E.,
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- Demarest, T. W.,
Supt. Motive Power,
Pennsylvania Lines,
Ft. Wayne, Ind.

- DeRemer, W. L.,
Rep., Spencer Otis Co.,
1707 Railway Exchange Bldg.,
Chicago, Ill.
- DeVilbiss, G. J.,
S. M. P., T. & O. C. Ry.,
Columbus, Ohio.
- Diamond, P. R.,
care of Canadian Bronze Co.,
Montreal, Canada.
- Dickinson, F. R.,
C. C. to Storekeeper,
B. & L. E. R. R. Co.,
Greenville, Pa.
- Dickerson, S. K.,
Ass't. S. M. P.,
L. S. & M. S. Ry.,
Cleveland, Ohio.
- Dix, John W.,
Salesman, Carnegie Steel Co.,
Carnegie Bldg.,
Pittsburgh, Pa.
- Donahey, I. W.,
Paymaster, U. R. R. Co.,
Port Perry, Pa.
- Donahue, C. J.,
Chief Clerk to Vice President,
L. S. & M. S. Ry. Co.,
Chicago, Ill.
- Donohoe, C. H.,
Genl. Yard Master,
P. & L. E. R. R. Co.,
Belle Vernon, Pa.
- Donovan, H. A.,
Clerk, Aliq. & Southern Ry.,
Woodlawn, Pa.
- Dorr, Charles O.,
Paymaster,
Monongahela R. R. Co.,
Brownsville, Pa.
- Dow, Geo. N.,
Genl. Mechanical Inspector,
L. S. & M. S. Ry. Co.,
Cleveland, Ohio.
- Drayer, U. S.,
Draftsman, P. R. R. Co.,
Altoona, Pa.
- Duckham, A. E.,
Civil Engineer,
House Building,
Pittsburgh, Pa.
- Duer, B. W.,
Supt., B. & O. R. R. Co.,
Chicago, Ill.
- Duff, Samuel E.,
Mgr., Riter-Conley Mfg. Co.,
50 Washington Ave.,
Bellevue, Pa.
- Dukesmith, F. H.,
Pres., Dukesmith Air
Brake Company,
Wabash Building,
Pittsburgh, Pa.
- Dunham, F. C.,
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25 Broad St.,
New York, N. Y.
- Dunlevy, J. H.,
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70 South 7th St.,
Pittsburgh, Pa.
- Dyer, Jos.,
Chief Joint Inspector,
P. & L. E. and
Erie R. R. Cos.,
Youngstown, Ohio.
- Eagan, J. H. D.,
President,
General Castings Co.,
Verona, Pa.
- Edmonds, J. F.,
Mgr., Garlock Pack. Co.,
Thaw Building,
Pittsburgh, Pa.
- Eichenberger, J. J.,
Freight Cashier, Penna. Co.,
North and Irwin Aves.,
Allegheny, Pa.
- Elder, Thos. W.,
Estimator, Pressed Steel
Car Company,
313 River Ave.,
Avalon, Pa.

- Elliott, A. H.,
Special Apprentice,
P. R. R. Co.,
Altoona, Pa.
- Elliott, G. H.,
Buyer, Republic Iron
and Steel Co.,
Pittsburgh, Pa.
- Elliott, J. B.,
M. M., B. & O. R. R. Co.,
New Castle Junction, Pa.
- Elmer, Wm., Jr.,
M. M., P. R. R. Co.,
28th Street,
Pittsburgh, Pa.
- Engstrom, Franz,
Civil Engineer,
American Bridge Co.,
Ambridge, Pa.
- Evans, R.,
Purchasing Agent,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.
- Evans, R. J.,
General Manager,
Franklin Mfg. Co.,
Franklin, Pa.
- Evans, Sam'l R.,
Yard Master,
P. & L. E. R. R. Co.,
Newell, Fayette Co., Pa.
- Everest, W. B.,
Traffic Manager, Westing-
house Elec. & Mfg. Co.,
East Pittsburgh, Pa.
- Fairman, H. T.,
A. G. Y. M., Penna Lines,
Hendrickson St.,
Conway, Pa.
- Falkenstein, W. H.,
Superintendent, Railway
Steel Spring Co.,
20th and Liberty Sts.,
Pittsburgh, Pa.
- Farnan, O. E.,
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4631 Second Ave., Hazelwood,
Pittsburgh, Pa.
- Felix, Otto F.,
Sec. & Treasurer,
Pittsburgh Supply Co.,
439 Water St.,
Pittsburgh, Pa.
- Fenwick, Wm.,
G. F. C. D., Wabash-
Pittsburgh Ter. Ry. Co.,
Canton, Ohio.
- Ferguson, O. G.,
Train Master,
Monon. Con. R. R.,
2nd Ave. near Bates St.,
Pittsburgh, Pa.
- Ferguson, W. L.,
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400 Federal St.,
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- Fettinger, H. O.,
Rep., H. W. Johns- Manville
Co., 329 Third Ave.,
Altoona, Pa.
- Fischer, Chas. L.,
Draftsman, Penna. Lines,
Allegheny Shops,
Allegheny, Pa.
- Fitz, E. M.,
Motive Power Inspector,
Pennsylvania Lines,
295 North High St.,
Columbus, O.
- Flannery, Jas. J.,
Prest., Flannery Bolt Co.,
Frick Building,
Pittsburgh, Pa.
- Flannery, Jos. M.,
Secretary, Flennery Bolt Co.,
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Pittsburgh, Pa.
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- Flinn, Howard,
V. P., Kidd Bros. & Burgher
Steel Wire Co.,
Aliquippa, Pa.

- Flynn, J. A.,
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Verona, Pa.
- Foley, F. J.,
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Spring Company,
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- Foller, Chas. S.,
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- Foster, F. B.,
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- Fraser, C. M.,
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- Freed, George F.,
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- Garrett, M. A.,
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- Gauss, E. E.,
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Lehigh Valley R. R. Co.,
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- Giles, J. T.,
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- Heintz, A.,
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W. A. B. Co.,
Wilmerding, Pa.
- Hempsted, Jas. G.,
care Wilmington Iron Co.,
Wilmington, Del.
- Hench, Norman M.,
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- Howe, David M.,
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- Huff, A. D.,
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Grand Trunk Ry.,
Park Bldg.,
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- Hughes, J. E.,
Yard Master,
P. & L. E. R. R.,
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- Hukill, J. L.,
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- Humphrey, A. L.,
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- Hunter, D., Jr.,
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- Hunter, H. S.,
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Chicago Pneumatic Tool Co.,
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- Hunter, Robert,
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Supply Company,
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- Jacoby, W. L.,
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- Jefferson, E. Z.,
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- Jennev, Jacob,
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- Jennings, F. R.,
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Penna. R. R. Co.,
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- Kearney, Alexander,
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- Keenoy, R. P.,
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Steel & Wire Co.,
15th St. and Penn Ave.,
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- Keith, Jno. T.,
care G. B. Markle & Co.,
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- Kelly, Moore,
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- Kennedy, D. B.,
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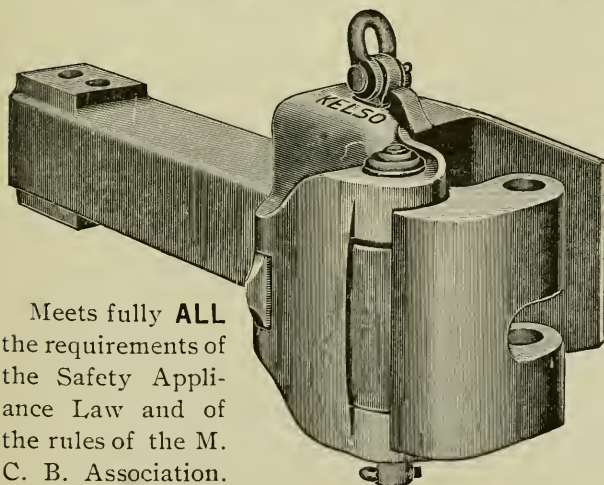
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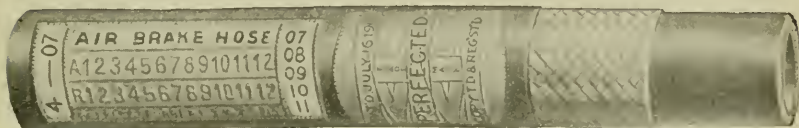
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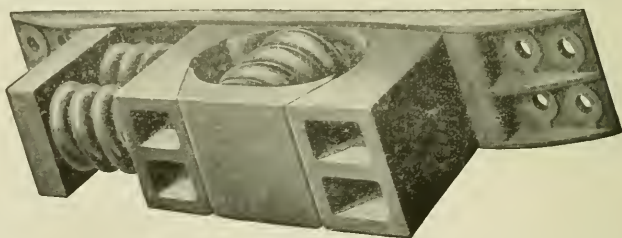
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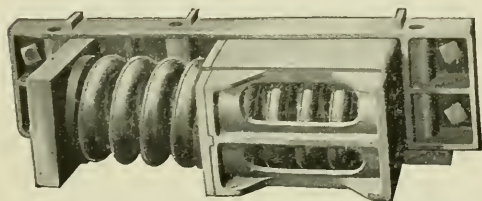
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